Journal of FORESTRY

SOCIETY OF AMERICAN FORESTERS 1900

A PROFESSIONAL JOURNAL DEVOTED TO ALL BRANCHES OF FORESTRY

VOLUME 47 NO. 3 MARCH 1949

Published by the SOCIETY OF AMERICAN FORESTERS

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The Society is not responsible, as a body, for the facts and opinions advanced in the papers published by it. Editorials are by the Editor-in-Chief unless otherwise indicated and do not necessarily represent the opinion of the Society as a whole.

Office of Publication, 825 Mills Building, 17th Street and Pennsylvania Avenue, N. W., Washington 6, D. C. Subscriptions, advertising, and other business matters should be sent to the JOURNAL OF FORESTRY, 825 Mills Building, 17th Street and Pennsylvania Avenue, N. W., Washington, 6, D. C. Manuscripts intended for publication should be sent to Dr. Hardy L. Shirley, New York State College of Forestry, Syracuse 10, N. Y., or to any member of the Editorial Staff. Closing date for copy, 18th of preceding month. The pages of the JOURNAL are open to members and non-members of the Society. Missing numbers will be replaced without charge, provided claim is made within thirty days after date of the following issue. Entered as second-class matter at the post-office at Washington, D. C. Published monthly. Subscriptions $6.00 a year; 60 cents a single copy. Acceptance for mailing at special rate of postage provided for in the Act of February 28, 1925, embodied in paragraph 4, Section 412, P. L. & R. authorized November 10, 1927. *Copyright, 1949, Society of American Foresters.*

Journal of Forestry

Official Organ of the Society of American Foresters

Editorial

Forest Management as a Business

PULP AND paper companies and more recently lumber companies have shown renewed interest in acquiring forest land. Present-day purchases are being made chiefly as long-term capital investments with production of repeated forest crops as the objective. Many of these companies already have a background of experience in forest management that demonstrates their ability to make good forestry pay. Their example is enticing many ordinary citizens to invest in forest land as a permanent income-producing property. Commitment by the casual forest investor places a new obligation on our profession. If these people make a financial success of holding their forest land, forestry will certainly boom. If a high percentage of them fail, forestry unquestionably will get a serious setback.

A forest investment offers several attractive features. It requires less close supervision than a farm. Timber grows in volume during good times and bad. Over the long run it has increased in value due to increased stumpage prices and increased accessibility. Of special value to investors in the high income tax brackets is the fact that forest growth is regarded as long-term capital gain rather than as current income thereby limiting the maximum tax rate on stumpage grown and harvested to 25 percent.

Good private forestry implies good business management. That is, it should be efficient, should give the nation more forestry for its money than can be had through public forestry, and it must be so attractive to the owners that it becomes widespread enough to guarantee a stable long-term supply of timber sufficient to meet the needs of our American economy.

As foresters we have had the blithe habit of taking certain business features of our profession for granted. To be sure, we have all recognized that a good forest investment must meet the following test: the soil must be productive, the land must be well stocked with valuable timber species, it should be accessible to good roads and markets, it should lie well for logging being neither steep nor swampy, taxes should be reasonable, the growth rate rapid, the property well blocked up, forest protection should be adequate against fire, insects, and diseases, and preferably supplied chiefly at public expense. The local population should have respect for the property rights of the forest owners. Few properties meet these specifications completely. The extent to which they fall short adds to both risk and cost. It also prolongs the period between initial investment and attainment of full income.

Experience in other business, and particularly in agriculture, indicates that a productive plant and a good product are not all that are necessary for financial success. Well-stocked farms with good land, fencing, equipment, and improvements and located on good roads near markets have not always proved profitable to owners. This led agriculturists to enquire into all the economic factors that together determine the financial success of the farm enterprise. They studied use of the farmer's own labor and of hired labor, determined use of machinery, use of fertilizer, quality of pasture management, skill in selling farm products, the effect of expenditures that improved the appearance of the property but added little to its productivity, waste on the part of the farmer and his family, and the effectiveness of planning of the farm enterprise. They also studied current and long-term markets and price trends as they affect the farm gross and net incomes, and rural living conditions in terms of human satisfactions. Out of this arose the new specialty farm management. Farm management using fields, flocks, herds, labor, improvements, and equipment with greatest over-all effectiveness has become the key to success.

Forest management needs to encompass a scope comparable to that of farm management. Our forest management is conditioned by public forestry, by large industrial holdings, or is still based primarily on European concepts. Maximum soil rent or maximum return on the capital

invested in soil and growing stock are emphasized. Little consideration has been given to providing continuous employment for the forest personnel, to determining the proper distribution of investment among land, improvements, growing stock, harvesting equipment, and merchandising forest products. What is the minimum-sized investment in land, equipment, and working capital for a successful forestry venture in the several regions? When is a forestry operation large enough to justify the owner purchasing a chain saw, a tractor, a logging truck, a bulldozer? What are the respective merits of renting versus owning such equipment? Of contracting logging versus owner doing it himself or selling stumpage? When can the operation support a sawmill? a planing mill? a lumber yard? At what volume of operation does the band saw become more economical than the circular sawmill? When can a full-time manager be employed? How much more efficient is a permanent than a temporary labor force? What proportion of the investment should be allocated to workers' housing? How flexible must operations be kept to take advantage of periods of high prices, and to salvage unusual losses resulting from fires, storms, insect attack and disease? These are all practical questions upon which the financial success of a forest enterprise depends and individual answers must be such that taken collectively the enterprise as a whole is a success.

Obviously the answers to such questions vary with region, market conditions, species and quality of timber, and the attitudes of local labor, forest operators, and taxing authorities toward a permanent forest enterprise. Especially we need to consider what value a forest has as a going business as opposed to simply a forest property on which valuable timber is standing but which has not yet been organized for sustained-yield operation. Always there exists the balance between applying intensive forestry on a moderate-sized area against extensive forestry on a larger area. The decision obviously should be made on the basis of which practice in the long run gives the best over-all results in terms of income to the property owner and stability to the people dependent thereon.

The problem as a whole has been faced and met successfully by more than one timber owner. One company in 1927 abandoned liquidation cutting in favor of selective cutting, new industries were brought in to use material other than sawlogs, so that business volume and prosperity of the company could be maintained without depleting the raw material resource. This company has applied modern business management principles to the entire forest operation. The records show that it has enjoyed as high an income during the period of sustained-yield operation as it would have enjoyed had it operated on a liquidation basis. Moreover it now has a fine growing business of indefinite life instead of cash resulting from liquidation for which it must seek another source of investment.

The problem faced by this lumber company on its relatively large holding of forest land differs in its fundamentals very little from the problems that face the owner of 50 or 100 acres of forest land. Each needs to know how rapidly the timber is growing, how to find a market for the several products the forest yields, how to apply labor to the property so as to get the highest return, what by-products the forest may yield in terms of thinnings for fence posts, fuelwood, poles for general construction, lumber for repairs to buildings, maple syrup, and other products offering profitable employment for labor. Each needs to know how he should distribute his investment in timber-harvesting equipment and working capital.

Fortunately, certain properties exist that are supplying this information. Among them are the Crossett Experimental Forest in Arkansas, the Pack Demonstration Forest at Warrensburg, the Luther properties in Saratoga, New York, the Watson property in Michigan, and the Goodman Lumber Company in Wisconsin. In addition, several individual farmers and other timberland owners have kept records that supply much of the information needed to build up the business management phase of forestry. Particularly valuable is the information now being collected by Connwood, by the New England Forestry Foundation, and the Otsego Forest Products Cooperative Association.

What is needed is recognition of the problem by the profession and the devoted effort of qualified men to work out the basic principles involved. Case material is indispensable; therefore cooperation from farm foresters, consulting foresters and others is essential to prompt solution. Much information can be accumulated from the wide experience in the South and other sections where long-term ownership and management exist. Can private forestry be expected to perform its proper mission without such economic guidance?

Management of Cut-Over Land in the Interior Ponderosa Pine Type

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Ponderosa pine cut-over stands, even when conservatively logged, are generally deficient in immature age classes. The picture of continuous cutting is clouded by an uncertain period between final removal of the old timber and a time when the younger classes can support a logging program. As a means of bridging the gap between the old and the new, the holding of old reserves has limitations in slow growth and high mortality. The ultimate answer is to build an adequate young growing stock as rapidly as possible. This task, already long neglected, presents the main problem in management.

LOGGING in western United States is still confined mainly to virgin stands. Although ponderosa pine in the national forests has been managed under a selective system for about 40 years, only insignificant areas have been cut a second time. A measure of the low importance attached to recuttings is seen in the fact that western forest experiment stations have done very little in that field. But at least two Regions are now giving serious attention to second cuttings to be followed by stand improvement; and the time when such operations become a part of management plans cannot be far off. What administrators need most is not yield tables from hypothetical cut-over stands, but living examples of stands which have been cut and re-cut with the object of building up the most productive type of growing stock.

Cut-over forests, even where conservative types of cutting have been practiced, vary greatly in volume, age, and condition of the remaining stand. The reasons are found partly in so-called methods of cutting, but even more in the character of the original stand. Virgin forests of the interior ponderosa pine type are characteristically over-mature and deficient in young age classes. Where a vigorous growing stock of desired age gradations is lacking after the stand has been logged selectively, it is generally because essential elements were lacking to bgin with. Modified practice during the past decade has corrected a former tendency to overstress removal of mature trees. This change has resulted in leaving substantially larger volumes for re-cutting, but has added little to the effective growing stock from a long-range point of view.

The dominant note in past cutting practice in national forests and Indian reservations has been salvage. Trees were cut on the basis of life expectancy. Those were marked for cutting which, according to the rules, would not live until the next cutting; and, conversely, almost any sound tree was left that might be expected to live. Not so long ago this philosophy was tersely expressed in the admonition "Never cut a sound blackjack or intermediate." Recently the favored class has been extended to include young yellow pines with large healthy crowns. But the competitive influence of "leave" trees upon their neighbors has been given little thought. Capacity for increment has been estimated in volume per tree rather than per acre, and without reference to lumber grades, even to the extent of deliberately favoring wolf trees over supposedly less vigorous trees of better form. The fallacies of this system and proposals for correcting it have been expressed in two previous articles (*3*, *4*). Reynolds (*8*) has made almost identical deductions concerning shortleaf-loblolly pine in Arkansas.

Classification of Cut-Over Stands

With respect to volume and age of residual stand and reproduction, cut-overs as found today may be divided into five broad classes:

1. Most of the volume in mature or near-mature classes, but with substantial representation of young age-classes, including good reproduction.

2. Nearly all the volume in mature classes; poor representation of blackjacks and poles, but good reproduction.

3. Similar to No. 2 but with poor reproduction.

4. Clear cuttings or heavy cuttings well restocked.

5. Clear cuttings or heavy cuttings with reproduction poor or lacking.

Of most immediate importance is the presence of merchantable sizes in volume sufficient to permit a second cut in the relatively near future; of more far-reaching importance is the presence of enough trees in immature classes to support a continuous cutting program. A long-range program must also envision successive waves of reproduction.

Perhaps there should be added a class in

which the young growing stock is made up largely of species other than ponderosa pine. This condition, common on sites of class 3 and better, indicates that ponderosa pine is going to lose prominence as time goes on, and that such stands are not ecologically in the ponderosa pine type.

Class 1

Class 1 comes nearest to offering the essentials for sustained high yield. If there is enough old timber to supply the bulk of the volume for two economic cuts at 20-year intervals, and if the younger stock, granting imperfect gradation of age-classes, will be able to maintain a steady flow of logs thereafter, the future of forestry is assured. Many "ifs" are encountered, among the first being the volume required for an economic cut, which on the average may be placed at about 2,000 board feet per acre, varying with such factors as roads, size and quality of logs. Young stands of sites 4 and 5 are capable of annual increments of 150 to 200 board feet per acre,but only if well stocked with trees in or approaching the sawlog class.

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FIG. 1.—Second cutting in a blackjack group of 27 trees after removing 43 percent of the volume. The four trees in the foreground range from 20 to 23 inches d.b.h.; all practically doubled their diameter growth rate after the second cutting. No. 2 from the left has two almost clear logs, grew 1.2 inches in 10 years before cutting and 1.4 in 5 years after cutting. The group as a whole, containing 12,799 board feet just before the second cut, grew at a rate of 134 board feet annually during the preceding decade; after removing 10 of the largest and poorest boles, the net annual increment rose to 175 board feet.

Here is where silviculture comes into play. It is generally agreed that silviculture begins with the first cutting, but there are those who would postpone an aggressive silvicultural program until all the old timber has been harvested. Really, it should begin in the virgin stand by encouraging advance reproduction and liberating young trees of good form when dominated by inferior ones. Improvement of the growing stock is necessarily a slow process, to be accomplished one step at a time, and for this very reason it cannot begin any too soon. The period during which old timber furnishes the bulk of the volume is the golden opportunity for management to prepare the young growing stock for the role which it must play later on. A previous article (*6*) points out the possibilities of improving increment in both volume and quality by silvicultural cutting in immature groups. A rise of increment in groups by as much as 40 percent during the first 5 years after cutting is not uncommon. Of still greater importance is the fact that this acceleration is accomplished mainly by removal of inferior stems whose water consumption is thus transferred to stems of better form (Fig. 1).

Figure 2 shows the trend of net increment on an area of 480 acres in the Fort Valley Experimental Forest during 30 years after cutting, the effect of a second cut at the end of 30 years, the probable gain if the second cut had been made 10 years earlier, and the probable loss if it had been deferred until 40 years after the first cutting (*6*).

Class 2

There is no definite line of demarkation between class 1 and class 2; class 2, however, is intended to embrace stands in which the young age classes are so deficient or so small in size that a considerable lapse in the cutting program is likely to occur after final removal of the old reserve. Assuming enough old timber for two re-cuts on a 20-year cycle there will be 60 years before the young generation is called upon to take over. And, assuming good advance reproduction in the virgin stand, 60 years should see many poles advancing into the 12-inch diameter class, but few will have attained desirable sawlog dimensions.

Offhand the way to bridge the gap between the old and the new may seem to lie in holding

large reserves of old timber or in extending the cutting cycle beyond 20 years. Both of these alternatives are subject to limitations (*5*).

It is easily possible to go too far in leaving large volumes of old timber. Large trees require much growing space; if not thus provided they stagnate and become a mark for bark-beetles. Regardless of spacing they are subject to damage by wind and lightning. Records in the Southwest show that a 24-inch "yellow pine" must grow at least 1 inch in diameter in 10 years in order to provide a small margin above average mortality, and that at 30 inches d.b.h. the growth rate must exceed 1 inch in order to keep out of the red. Perhaps mortality is higher in the Southwest than in other sections of the interior region, but so also is diameter growth. At least the principle is one to bear in mind wherever moisture is a limited factor.

Table 1 shows the downward trend in diameter growth of large trees over a period of 20 years, on an area of 160 acres logged in 1924. The residual volume was 3,500 board feet per acre, 26 percent of which was yellow pine. Out of 243 trees 24 inches d.b.h. and larger in 1925, 28 or 11.5 percent had died by 1945. Average diameter growth is based on those which lived through the entire period. During the first 10 years 76.3 percent grew 1 inch or more in diameter; during the second 10 years only 37.2 percent attained this rate; and during the last 5 years 47.9 percent grew only 0.3 inch or less.

The trees in Table 1 were for the most part widley spaced, being remnants of yellow pine groups which were heavily cut under a method designed to favor dominants. In addition to the trees which died, some declined as a result of lightning damage or stem rust (*Cronartium filamentosum*). But diameter growth also fell off in full-crowned trees which bore no signs of physical injury or disease. Their growth decline is attributed to root competition, mainly from sapling thickets which by 1945 had attained a height of 6 to 8 feet (Fig. 3).

Few stands in the interior region are so constituted that volumes of over 5,000 board feet in the mature class can be left to advantage as long as 20 years. Exceptions may occur if distribution is unusally good and diameters well below 24 inches. But even with good distribution, reproduction invading the root zone will depress growth. Such stands can be kept alive by frequent salvage cutting; but what is gained by expensive salvage if the trees are not growing? The best chance to prolong the life of the old classes is to release small subordinates within yellow pine groups (Fig. 4).

Class 3

The essential difference between class 2 and class 3 is that the latter has not restocked, meaning as a rule that advance reproduction was lacking in the virgin stand. General absence of young age classes indicates that factors adverse to regeneration have been at work over a long period and are likely to continue unless remedial measures can be applied. All ponderosa pine regions have areas of this kind; in the Southwest are sizable units on which even the famed 1919 wave of reproduction failed to leave its imprint. Without blackjacks, poles, saplings, and seedlings ready to take advantage of cutting release, silviculture faces an unhappy prospect.

Under a program of conservative cutting with salvage, stands of this kind can be made to yield some net increment. Conservative cutting, however, does not imply leaving large trees so close together that they cannot grow and bear seed. Since cutting in these stands will deal with mature trees of relatively large size, it may be possible to operate on a cycle as short as 10 years. Generally, the largest stems should come out first, bearing in mind that a 30-inch tree uses as much water as several 18-inch trees, and that the smaller ones have a great advantage in life expectancy. If the first cut leaves as much as 5,000 board feet per acre, it may be possible to defer final removal as much as 100 years. During this period the primary aim must be regeneration, and reconstruction of the stand.

Class 4

Heavy cuttings, old and recent, range all the way from high-ing, in which inferior trees, poles, and saplings were spared, to clean cutting followed by fire. For the purpose of this discussion cut-overs of the first type are placed in class 4 and those of the second type in class 5. In class 4 the residuals have usually been supplemented by later reproduction, resulting in well-stocked stands sometimes nearly even-aged but more often containing several age-classes. In the Southwest, pre-national forest cuttings which escaped fire afford the region's best examples of a many-aged forest. Where such stands occur on privately owned lands they have in many instances been subjected to destructive recutting. In the Fort Valley Experimental Forest a second cut on 300 acres, 60 years after

TABLE 1. DISTRIBUTION OF TREES 24 INCHES AND LARGER BY DIAMETER GROWTH CLASSES DURING THE FIRST AND SECOND DECADES AFTER CUTTING

Diameter growth per decade	First decade		Second decade	
	Number	*Percent*	*Percent*	*Percent*
2 inches or more	21	9.8	0	0
1.5 to 1.9 inches	53	24.6	18	8.4
1.0 to 1.4 inches	90	41.9	62	28.8
0.4 to 0.9 inch	31	14.4	32	14.9
0.3 inches or less[1]	20	9.3	103	47.9
Total	215	100.0	215	100.0

[1] Applies to first and last (or fourth) five-year periods instead of decades.

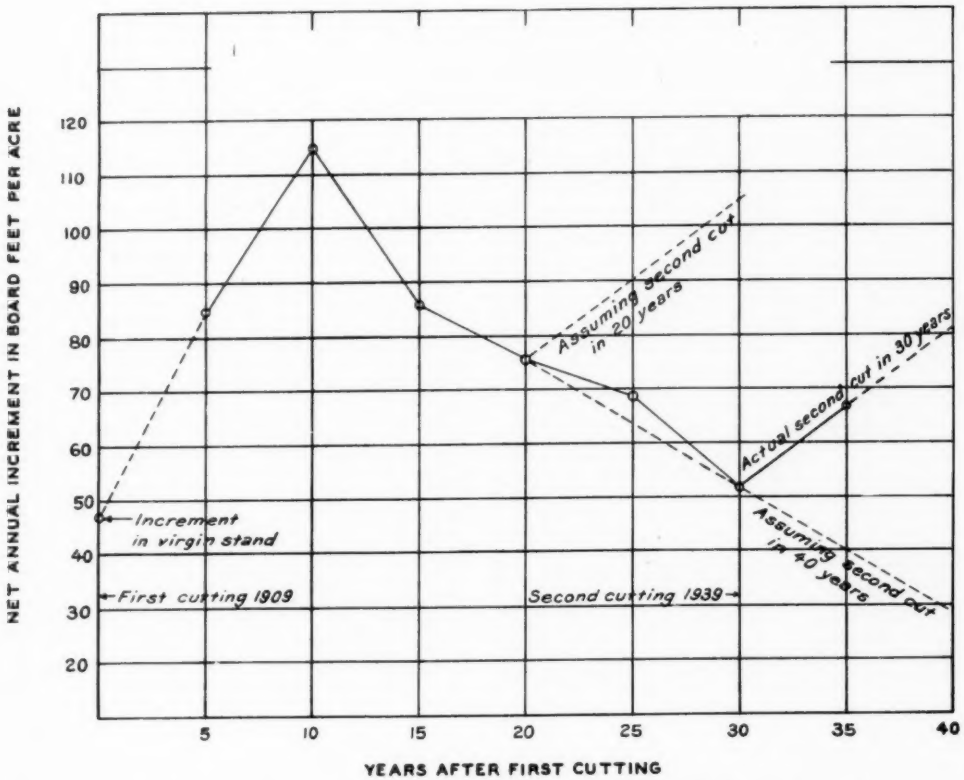

FIG. 2.—Net annual increment of ponderosa pine by 5-year periods after first and second cuttings. Wing Mountain area, Fort Valley Experiment Forest. (Broken lines by extrapolation.)

the original "loggers selection," removed 2,000 board feet per acre and left a slightly lower volume in blackjacks supplemented by a wealth of poles and saplings.

Because stands of this type usually contain many wolf trees and other unprofitable dominants, a second cut should be made as soon as the available volume warrants logging. In the national forests the net proceeds of sale should be diverted into the Knutson-Vandenberg[1] fund for stand improvement in the pole class. Experience in the Fort Valley Experimental Forest has disclosed the fact that usually there were enough good poles to provide adequate stocking after the undesirable ones were eliminated.

The Pacific Northwest Experimental Station reports on an even-aged, 102-year-old second-growth stand on site 3 which was logged in 1938 (*2*). The original volume per acre was 24,581 board feet, of which 6,123 board feet or 25 per-cent was removed, taking out the largest trees. Net annual increment during the first 6 years after cutting was 566 board feet per acre as compared with 618 board feet on the uncut control plot. There are reasons to expect that in the next 10 years the cut-over stand will overtake and surpass the uncut one. And, assuming that the poorest dominants were removed, values increment should prove to be an important item. The high rate of increment is most gratifying, and although sites 4 and 5 cannot be expected to equal site 3, these sites when fully stocked with young trees are likely to register yields far exceeding anything experienced in partially stocked old growth.

[1]Refers to an act authorizing the expenditure of national forest stumpage receipts for improvement of the stand.

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FIG. 3.—A 31 inch tree of intermediate age class 20 years after logging. Diameter growth in inches by 5 year periods 1925 to 1945: 0.6, 0.6, 0.5, 0.0 Reproduction was 6 inches to 1 foot high at the time of cutting. Since the tree bore no external evidence of deterioration, decline of growth was attributed to root competition from the dense sapling stand. This tree was removed in the second cutting in 1946.

Class 5

Clean-cut areas which have not restocked are a doubtful timber asset in regions of high planting costs and slow growth. It should be borne in mind, however, that the difference between "restocked" and "not restocked" is not distinct. Even though restocking may fall far short of arbitrary standards of "satisfactory," it may be possible by protection and stand improvement to develop a fairly good growing stock. In Southwest as few as 50 well-distributed sapling per acre can form the basis of a productive stand. Pruning is necessary, but pruning 50 trees is far cheaper than planting 1,000 successfully. Moreover, any plantations in the

FIG. 4.—A yellow pine group logged in 1909 and again in 1939. No. 9, a 30 inch tree, was cut in 1939; Nos. 6 and 7 in the 24 inch class in 1939, were about 21 inches d.b.h. in 1909. Nos. 0, 5 and 8 were all subordinates below merchantable size at the time of the first cutting; diameter growth in inches 1929 to 1939: 2.2, 1.9, and 2.3; only No. 8 accelerated after the second cut. As a result of early crowding, all have a clear butt log. White cards mark stumps of trees cut in 1909.

Southwest, however successful, would call for stand improvement in order to produce trees of sawtimber form.

Conclusions and Suggestions

American forestry faces a day of reckoning when the old-growth timber reserves are gone. Persistent study of ponderosa pine increment leads more and more to the conclusion that this valuable species, even where conservative cutting has been practiced, is contributing far too little toward tomorrow's timber budget. Admittedly, ponderosa pine occupies the driest sites of any sawtimber species; but it is reasonably certain that these sites are capable of producing four times the present increment. Cutting prior to the last decade was too heavy; but, contrary to a common impression, increment is not benefited by a large residual volume except as it contributes toward efficient utilization of the soil.

Sustained high increment calls for good stocking with well-spaced immature trees, increasing in number from about the 22-inch class downward, and including an abundance of poles advancing toward sawlog size. In the interior ponderosa pine type, scarcely 10 percent of the stands can meet this specification.[2] The reasons are fairly obvious. Large trees require much ground space. They can grow to a diameter of 50 inches only by suppressing younger generations. The heavier and more vigorous the old stand the less opportunity for saplings to advance into pole stage and poles into blackjack stage. Only as the old stand deteriorates can reproduction make headway, and only after some disaster decimates the old stand can a new generation make effective progress.

Clearly, the formost task of silviculture is to build a new growing stock which can reinforce a waning output of sawlogs from old timber. By and large, this is a slow process, requiring from 50 to 100 years or more, depending on the character of the stand when it is taken in hand. Fortunately, most virgin stands now have considerable advance reproduction, and cut-overs usually have enough saplings and pole growth to provide two age-classes. But there is almost a universal dearth of small stems capable of attaining log size in 50 to 75 years. To make matters worse, the old reserve on some cut-overs is barely sufficient for two recuts 20 years apart. Release cutting, where not too long delayed, can greatly improve the future growing stock, but much valuable time has already been lost.

For many years to come the main and perhaps only opportunity for improving the growing stock will be associated with commerical cutting —directly by removal of merchantable but undesirable dominants, and indirectly by providing funds under the Knutson-Vandenberg Act for release and pruning.

Salvage operations such as are now being practiced in virgin stands have strong possibilities in that they are timely and capable of covering ground rapidly. But salvage should have a higher purpose than merely saving the wood content of dying and defective trees. It should also remove low grade dominants which are suppressing smaller trees of better form. Transcending the idea of selling a few dying and silviculturally harmless trees should be the thought of putting new vigor into many times their number of potentially valuable subordinates which are being held back not by dying trees but by lusty wolf trees which will live indefinitely.

Harvest cuttings should go much farther in the rehabilitation of growing stock than is possible in light salvage. Liberation of potential growing stock should be extended to the inclusion of small, clean-boled subordinates of the mature age class (*7*). Stress should be placed on leaving as many small, well-distributed trees as possible, rather than merely a large residual volume. Silviculturally, the volume we leave is far less important than what we leave and where.

Re-cutting should follow up the program of improving the growing stock, if indeed it is not the first effort in that direction. If old residuals can furnish enough logs for more than two cuts, all to the good; and if the interval between cuts can be reduced from 20 years to 10, substantial benefits both in current increment and in improvement of growing stock will accrue. Large, low-grade blackjacks in isolated positions may be held for the purpose of bolstering up future cuts; but in no case should such trees be allowed to dominate smaller ones of better form, and this applies also to poles and saplings (Fig. 5).

For many decades to come the volume required for an economic cut will continue to be an

[2] In a class 1 stand at Fort Valley, bearing a residual volume of 8,000 board feet per acre, the number of trees per acre 8-11 inches d.b.h. was 4.20, and the number 12-20 inches 8.42. Corresponding figures for loblolly-shortleaf pine as given by Reynolds (*8*) are 43.4 and 23.9.

object of concern to forest managers. They should bear in mind that the lower limit is determined not so much by volume per acre as by size and quality of logs (*1, 9*). In old growth, quality is on the average directly related to diameter, but this need not be the case after a forest has been managed through several cutting cycles. The diameter of logs will undoubtedly decrease, but if foresters do their duty quality will trend continually upward.

In the national forests the job which more than others is going to call for the best silicultural talent is overhauling the growing stock on millions of acres logged during the past 40 years. Funds for stand improvement are going to be short because of the small volumes on which Knutson-Vandenberg funds can be collected. Nevertheless, second cuttings can in some measure correct errors and omissions of the first cutting if they are not delayed too long. Second cuttings can open up blackjack groups and remove inferior diminants that are retarding the younger generation. But they cannot replace small trees which were cut merely because their crowns were small, nor can they restore already suppressed poles and saplings. What was overlooked in the past is water under the bridge, but the future holds a direct challenge. The responsibility lies most heavily on research which should lead the way by experimental management and demonstration.

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FIG. 5.—A 29-inch wolf tree left in 1924 cutting, removed in 1946 cutting. During this 22-year interval it suppressed or retarded the growth of smaller trees to an extent far exceeding the value of its own increment.

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A Revised Tolerance Table

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A table showing the tolerance of most of the important trees of the United States was prepared by Zon and Graves in 1911, and has been reprinted since. A revision after 40 years of experience seems desirable. In canvassing opinion, a number of interesting points developed which suggested a little philosophizing on the whole matter of tolerance.

"TOLERANCE" as it refers to forest trees in a word that is for more revered in the classroom than in the forest. Nevertheless, foresters would find it difficult to get along without the term. It rests upon the most natural of observations. Even two thousand years ago the differences of the growth of plants beneath the shade of others was noted. "Shade acts as a kind nurse or a harsh step-mother," says Pliny,[1] who points out how the grape grows well under the thin shade of fig, grass flourishes under sycamore, but under the dense shade of pine nothing grows well.

In the twentieth century, however, foresters turned scientific, tried to determine what constituted the true nature of "tolerance" and found that it was not a scientific concept at all[2] So, growing self-conscious about the debatable term, they very generally dropped its use. Present-day opinion seems to regard it as something for silvicultural theorists to kick around.

That undeserved fate may unfortunately be in store for it, but it is surely equal to many good words in the English language which, though incapable of rigorous definition, lead useful, picturesque hard working lives. There is no need to drop the term "tolerance" just because it is not scientific. Take the well-known terms: intolerant—intermediate—tolerant—and lay them up against the similar words: young—middle-aged—old.

What makes a man young? Years? Color of hair? Springiness of step? Glands? Teeth, And when does he pass from youth into middle age and from middle age to old? These are obviously rhetorical questions; not the wisest of men knows the answer. But we do not, therefore, consign these terms to oblivion. Rather, we use them and their derivations well and picturesquely. "Old before his time," "prematurely grey," "aged a lot the past year," "holds his age well"—dozens of phrases express a wealth of wholly unscientific but useful ideas. Similarly, we are free to use terms relating to tolerance in much the same way—and probably would do so if we did not labor under the impression that here we had to be "scientific." I think most foresters have a distinct impression of the meaning of "tolerant in youth," "intolerant on poor sites," "intolerant in poorly drained soils," "more tolerant in the south." Scientifically we have only the slightest knowledge of what is really meant.

Admittedly all foresters do not see eye to eye when it comes to definitions of tolerance. But then, neither do we when we discuss age, health, liberalism, democracy, freedom, or a thousand-and-one other topics of the day. So, without in any sense disagreeing with Shirley's position that scientifically the word "tolerance," as the forester uses it, cannot be defended, it seems to deserve much better treatment than it currently receives—simply as a *useful* word.

Ever since the writer's *Theory and Practice of Silviculture* appeared in 1934 criticisms of the tolerance tables of Zon and Graves[3] which are reprinted there have been received. Partly out of curiosity to see whether there was unanimity in tolerance ratings of trees among American foresters and partly because it seemed that a more complete tolerance table, resting upon the mature judgment of a greater number of men might be desirable, a questionnaire was sent out to a number of foresters—mostly connected with schools and experiment stations. There was no thought of thoroughly canvassing the field, but it is believed that the 55 returns which came back, together with other published statements, give a fair cross section of opinion. The resulting table (Table 1) differs little from the original Zon and Graves ratings, although a number of additional species are listed.

A number of returns brought letters with them offering wise criticisms. The most common criticism— with which I am in full accord —was that any table of this type listing species which may never grow together naturally is rather unsatisfactory. And, conversely, a local

[1]Plinius Secundus. C. The natural history of Pliny. Trans. by J. Bastock and H. T. Riley. Vol. 3. London. 1885.

[2]Shirley, H. L. Is tolerance the capacity to endure shade? Jour. Forestry 41:339-345. 1943.

[3]Zon, R. and H. S. Graves. Light in relation to tree growth. U. S. Dept. of Agric. Forest Ser. Bul. 92. 1911.

table made up of trees that naturally mingle is not only better, but can recognize far smaller tolerance differences than appear in a general table.

Several writers pointed out the change in tolerance with age, which seems particularly marked with some species. This makes it difficult to assign the tree to a fixed tolerance class.

Others noted the differences of opinion among themselves and their colleagues stemming from varying ideas both as to the nature of tolerance and the criteria by which tolerance is judged. The latter factor is, for example, very obvious in the tolerance ratings which were assigned to western species by Sudworth[4] who apparently considered the presence of reproduction on the forest floor a primary mark of tolerance. In the summer-dry climate of California such reproduction is almost *nil*, so he lists hardly any tolerant species in California in spite of the fact that crown density, clear length and leaf characters indicate a tolerant nature. It is difficult to estimate the importance of variation in our concepts of tolerance. In almost no case was there perfect unanimity as to tolerance rating. In general, however, there was good agreement, and in cases where wide disparities appear in Table 1, the character of the tree is generally such that satisfactory assessment of its tolerance is not easy. One oddity cropped up in this connection. Surprisingly often outstanding men in the field of silviculture—mature, experienced, and of undoubted judgment—took the minority point of view in rating the tolerance of a given species. We are at a loss to account for this, but the disturbing suggestion has been made that most of us accept the things we learned in school as the gospel truth; only a few of the best learn to observe and think for themselves.

As so often happens when amateurs set up questionnaires, opinions on tolerance were asked in such a way that agreement with the Zon-Graves table might be construed as "no opinion." Disagreement with the older table was clearly stated. For this reason, the present table may well overemphasize the disparity of opinion among foresters. The percents shown in the more popular groups in the table are perhaps too low. The spread of opinion is not affected, however.

There is, of course, no intent to set this table up as representing fixed silvical characteristics belonging to the various species; scientific facts are not determinable by popular vote. It is believed, however, that it represents the general consensus of opinion of American foresters, regarding the tolerance of trees, and as such may be of some value.

[4]Sudworth, G. B. Trees of the Pacific Slope. U. S. Dept. of Agric. Forest Ser. 1908.

TABLE 1.—TOLERANCE OF AMERICAN FOREST TREES, BASED ON WORK OF ZON AND GRAVES, REVISED[1]

EASTERN CONIFERS

VERY TOLERANT

Red spruce (50)	*Northern white-cedar* (42)
Eastern hemlock (100)	Atlantic white-cedar (55)
Balsam fir (60)	

TOLERANT

Red spruce (50)	Northern white-cedar (42)
Black spruce (77)	*Atlantic white-cedar* (18)
White spruce (82)	

INTERMEDIATE

Eastern white pine (72)	Slash pine (55)
Eastern redcedar (20)	*Virginia pine* (37)
Pitch pine (35)	Baldcypress (14)
Loblolly pine (36)	

INTOLERANT

Eastern redcedar (50)	Loblolly pine (53)
Red pine (60)	*Slash pine* (33)
Pitch pine (45)	Virginia pine (47)
Shortleaf pine (45)	*Baldcypress* (21)

VERY INTOLERANT

Tamarack (83)	Longleaf pine (80)
Eastern redcedar (30)	*Shortleaf pine* (32)
Pitch pine (20)	*Baldcypress* (58)
Jack pine (84)	

EASTERN HARDWOODS

VERY TOLERANT

Eastern hophornbeam (67)	American holly (80)
	Sugar maple (71)
American hornbeam (67)	Flowering dogwood (70)
American beech (65)	

TOLERANT

Rock elm (50)	Basswood (46)
Sycamore (26)	Tupelos (47)
Red maple (69)	Persimmon (40)***
Silver maple (50)	Buckeyes (100)***
Box elder*	

INTERMEDIATE

Hickories (41)	Magnolias (53)**
Yellow birch (61)	*Sycamore* (26)
Sweet birch (55)	*Black cherry* (45)
American chestnut (100)	*Silver maple* (43)
White oak (74)	*Basswood* (38)
Red oak (59)	*Tupelos* (29)
Black oak (55)	*Persimmon* (30)**
Other oaks*	White ash (50)
American elm (59)	Green ash (55)
Rock elm (50)	Black ash (60)
Hackberry (100)**	

[1]Most acceptable rating is shown in roman type. In cases where considerable preference for other categories was expressed the name appears in italics. The numbers following the species name indicate percent of respondents voting. Species names follow Forest Service check list. (Little, E. L. Check list of the native and naturalized trees of the United States, Including Alaska. U. S. Dept. of Agric. Forest Ser. Mimeog. 1944.) Oaks, other than the most common, were not sufficiently covered for satisfactory rating. Items marked (*) classed by Baker, on basis of small amount of variable data. Items marked (**) have poor base data. Items marked (***) classification very uncertain.

INTOLERANT

Black walnut (60)	Sycamore (37)
Butternut (80)	Black cherry (50)
Pecan (75)	Honey locust (75)
Hickories (48)	Kentucky coffeetree (100)**
Paper birch (83)	*Tupelos* (23)
Red oak (32)	*Persimmon* (30)***
Black oak (45)	*White ash* (38)
Yellow-poplar (75)	*Green ash* (45)
Sassafras*	*Black ash* (30)
Sweetgum (62)	Catalpas (100)***

VERY INTOLERANT

Willows	Cottonwoods (88)
(S. bebbiana tolerant)	Gray birch (100)
Quaking aspen (88)	Black locust (100)
Bigtooth aspen (83)	Osage orange (100)***

WESTERN CONIFERS

VERY TOLERANT

Sitka spruce (33)	*Redwood* (40)
Western hemlock (83)	Western redcedar (57)
Grand fir (42)	Pacific yew (75)
White fir (29)	California torreya (55)
Alpine fir (67)	

TOLERANT

Sitka spruce (50)	Redwood (60)
Engelmann spruce (80)	*Giant sequoia* (25)
Douglas-fir (20)	Incensecedar (75)
Mountain hemlock (50)	*Western redcedar* (43)
Pacific silver fir (80)	Port Orford white-cedar (80)
Red fir (38)**	
Grand fir (50)	Alaska yellow-cedar***
White fir (71)	*California torreya* (45)

INTERMEDIATE

Western white pine (54)	*Bigcone-spruce* (50)***
Sugar pine (60)	Red fir (0)***
Monterey pine (57)	Giant sequoia (50)
Bishop pine (50)	
Blue spruce (67)***	
Douglas-fir (60)	

INTOLERANT

Western white pine (35)	Bishop pine (50)
Limber pine (50)***	*Douglas-fir* (20)
Pinyon***	Bigcone spruce (50)***
Ponderosa pine (80)	*Red fir* (38)***
Jeffrey pine (100)	Noble fir (100)
Lodgepole pine (82)	*Giant sequoia* (25)
Coulter pine (57)	Junipers***
Knobcone pine (63)	

VERY INTOLERANT

Whitebark pine (50)***	Digger pine (67)
Foxtail pine (80)	Western larch (100)
Bristlecone pine (50)	Alpine larch (100)

WESTERN HARDWOODS

VERY TOLERANT

Vine maple*

TOLERANT

Red alder (37)***	Bigleaf maple (75)
Golden chinquapin (25)***	Madrone (57)
Tanoak (75)	California laurel (55)
Canyon live oak (67)***	

INTERMEDIATE

Red alder (14)***	California white oak (50)***
Golden chinquapin (50)**	Oregon white oak (50)***
Oregon ash (75)	*Madrone* (43)

INTOLERANT

Red alder (37)***	*Oregon white oak* (50)***
Golden chinquapin (25)***	*California laurel* (45)
California white oak (50)***	

VERY INTOLERANT

Quaking aspen*	Cottonwoods*

"MANY forest officers in the drier tracts are so obsessed with the over-grazing problem and its terrible reactions upon the community as a whole that they have given up hope of ever achieving reasonable conservation and are reconciled to the idea that the community is headed for destruction. The reserves, already much too small, are being whittled down to meet every fresh political agitation. Grants of fresh grazing land or grazing concessions merely stimulate a further increase of stock, and in a short time the new grounds are destroyed or reduced to the common level of eroded desolation."[1] (Page 57.)

"GEOLOGICALLY the whole of the Siwalik foothills and much of the Salt Range upland is so unstable that any form of grazing must inevitably lead to disaster. Merely by letting cattle graze for a few seasons, deep gullies appear, causing ruination of the natural grassland by destroying the underground moisture balance. The only hope of making a better use of such land is to eliminate grazing altogether, and persuade the people to harvest the grass as hay and feed their cattle at the foot of the hills."[1] (Page 60.)

[1]From "Soil and Water Conservation in the Punjab," by R. MacLagan Gorrie. Forest Department, Punjab (India), 1946.

Estimating Tree Heights from Shadows on Vertical Aerial Photographs

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The use of aerial photography in forestry is increasing by leaps and bounds. As in any new and expanding field, there are many challenging problems to be solved. There is a need for methods and techniques that are practical and easy to use. In this article the author attacks one of these problems; he offers a short-cut method of estimating the height of trees by measuring the shadows on aerial photographs. Information that can be obtained this way is frequently useful to foresters in estimating forest conditions before making ground surveys.

AERIAL photographs are now being applied more and more to practical forestry—especially to forest survey. Many forest characteristics can be recognized on aerial photographs in greater detail than is possible through ground methods alone. The basic need is for tools and methods for interpreting the detail in quantitative terms.

Tree heights determined from aerial photographs can be used in estimating timber volume. Studies of white pine, northern hardwood, and spruce-fir forests—conducted in cooperation with Harvard Forest—indicate that tree height is correlated with tree volume. The degree of correlation varies with species being higher in spruce-fir forest than in the northern hardwoods.

Tree heights may be measured on vertical aerial photographs by three methods: Shadows, parallax, and displacement. Each technique has its advantages and disadvantages.

Seeley[1] has developed the technical procedures for measuring tree heights from shadows on vertical aerial photographs, and has also devised a system that reduces the compilation needed to convert shadow length to tree height. Seeley's methods were first applied to forestry in this country in 1942, when the Northeastern Forest Experiment Station experimented with aerial photographs in a survey of the forests of the anthracite region of Pennsylvania.

These first attempts to determine timber volume from tree shadows showed promise. A crude volume table was constructed, based on total heights; and timber-stand volumes were estimated from tree heights and the number of trees. (The number of trees was based on a count of tree crowns.) Preliminary checks made at that time were not exhaustive, but they were so encouraging that 3-1/4 million acres of forest land were surveyed with aerial photographs and the tree-shadow technique. Later the same methods were used in interpreting the forest situation on about 75 million acres of forest land in the Northeast. At present the tree-shadow technique is being used extensively in the Northeast in the Forest Service's flood-control surveys as well as in forest surveys.

For this survey work in the Northeast, about 250 men have been trained to measure tree heights from shadows. The ease with which they mastered the technique indicates that wide application of this system is possible. Present information shows that, with the shadow technique, experienced persons can estimate tree heights within 7 feet, two times out of three, at photo scales of 1:20,000. The inexperienced student can seldom attain this accuracy, but with practice he can quickly become proficient.

Orienting the Stereo Pairs

The stereoscope is essential for studying tree heights and land configurations on aerial photographs. Stereoscopic study provides a three-dimensional view of the land surface that is invaluable in selecting and measuring tree shadows. A direct-vision lens-type stereoscope is satisfactory.

The two aerial photographs used with the stereoscope are oriented as follows. First, arrange the pair of photographs so that the overlapping parts are adjacent. (Each photograph contains about 60 percent of the image in the other photograph.)

Next, determine the principal point (optical center) of each photograph. This is done by means of the fiducial marks that are printed on the sides or in the corners of each photograph. The intersection of two lines connecting opposite fiducial marks will indicate the principal point. Actually, you do not need to draw a line across the whole photograph; a short line near the center is sufficient.

Since the images of the two photographs overlap by about 60 percent, each principal point will also appear on the other photograph. Carefully mark each of these points on the other

[1] Seeley, H. E. Tree heights from shadows. Photogrammetric Eng. 8: 100-109, illus. 1942.

photograph. Each of these is called a conjugate principal point. Now each paragraph is marked with two points, a principal point and a conjugate principal point. Adjust the two photographs so that a straight line will pass through all four points (Fig. 1).

The final step is to move the photographs closer together or farther apart to the proper distance, meanwhile keeping the four points alined. The distance to move the photographs depends on the stereoscope used. There is a simple test for determining this distance.

Place a sheet of paper under the stereoscope. While looking through the stereoscope, make a dot under the left lens. Mark a dot under the right lens on the spot where the image of the first dot appears to be. Measure the distance between the two dots. This is the proper distance to seperate the two images. When the adjustments are made, fasten the two photographs securely to the table with scotch tape or thumbtacks.

When the stereo pairs are oriented this way, you should have no trouble in seeing stereoptically. But make certain that an imaginary line through the centers of the two stereoscope lenses is parallel to the line drawn through the four points on the photographs.

Measuring Tree Shadows

The tree shadows may be measured with any good engineering rule. However, a "shadow wedge" developed by Seeley is more accurate and easier to use. This instrument, printed on transperent celluloid, consists of two converging lines, with the distance between them scaled in graduations of 0.01 inch (Fig. 2). The shadow is measured by fitting the wedge over it so that the shadow lies squarely within the wedge, with the edges of the shadow just touching the edges of the lines. This should be done carefully; otherwise, the heights will be underestimated.

A more recent device, also developed by Seeley[2] is a "pole scale." This consists of a number of lines, of different lengths, printed on some transparent material. You simply fit the lines over the shadow until you find a line that matches the shadow in length. The idea looks promising.

Cautions

The measurements of shadows is subject to many sources of error. In general, the interpreter tends to underestimate because of the lack of distinct shadow from slender tree tips. Keen observation, supplemented with frequent ground checking, is needed to develop the judgment for detecting errors and eliminating them. The more serious errors may be eliminated or greatly reduced if the following factors are considered.

A slope may elongate or shorten the shadow (Fig. 3). Shadows on slopes should be avoided. All shadows measured should be located on flat or nearly flat land surface. Then, tree heights estimated from shadow measurments may be compared by stereoscopic study with those on slopes.

The crown canopy of the forest frequently prevents visual detection of gullies and knolls (Fig. 4). However, the study of tree heights and crown sizes as compared with the stand density may indicate the presence of such configurations of the land surface. For example, we observe a group of trees with large crowns, surrounded by groups of trees with small crowns; and all the heights appear about the same. We suspect that the larger-crowned trees should be taller. But, since they do not appear any taller, it is reasonable to believe that they are in a gully. In other words, we construct the hidden configuration of the land surface through study of tree sizes. The depth of such a gully is assumed to be partially correlated with the difference in crown sizes. By a similar type of analysis, we may detect the presence of hidden knolls.

Trees should be selected whose shadows lie on the ground (Fig. 5). The height of trees whose shadows lie on the underbrush or snow will be underestimated because the shadow is shortened. This is a common error in the use of shadows. Since desirable shadows are not always available, shadows in underbrush or snow may have to be measured. In this case the height of the snow depth or brush depth is estimated and added to the tree height obtained from the shadow.

Frequently clear shadows cannot be found because of interference from other trees (Fig. 6); thus, the shadows are not completely visible. This error is aggravated when the sun is low in the sky, producing extremely long shadows. In such cases, you should locate and measure only trees with clear shadows, then compare the heights of these trees by stereoscopic study with those whose shadows are not distinct.

[2]Seeley, H. E. Pole scale. Canada Dept. Mines and Resources Aerial Survey Leaflet 1. 1948.

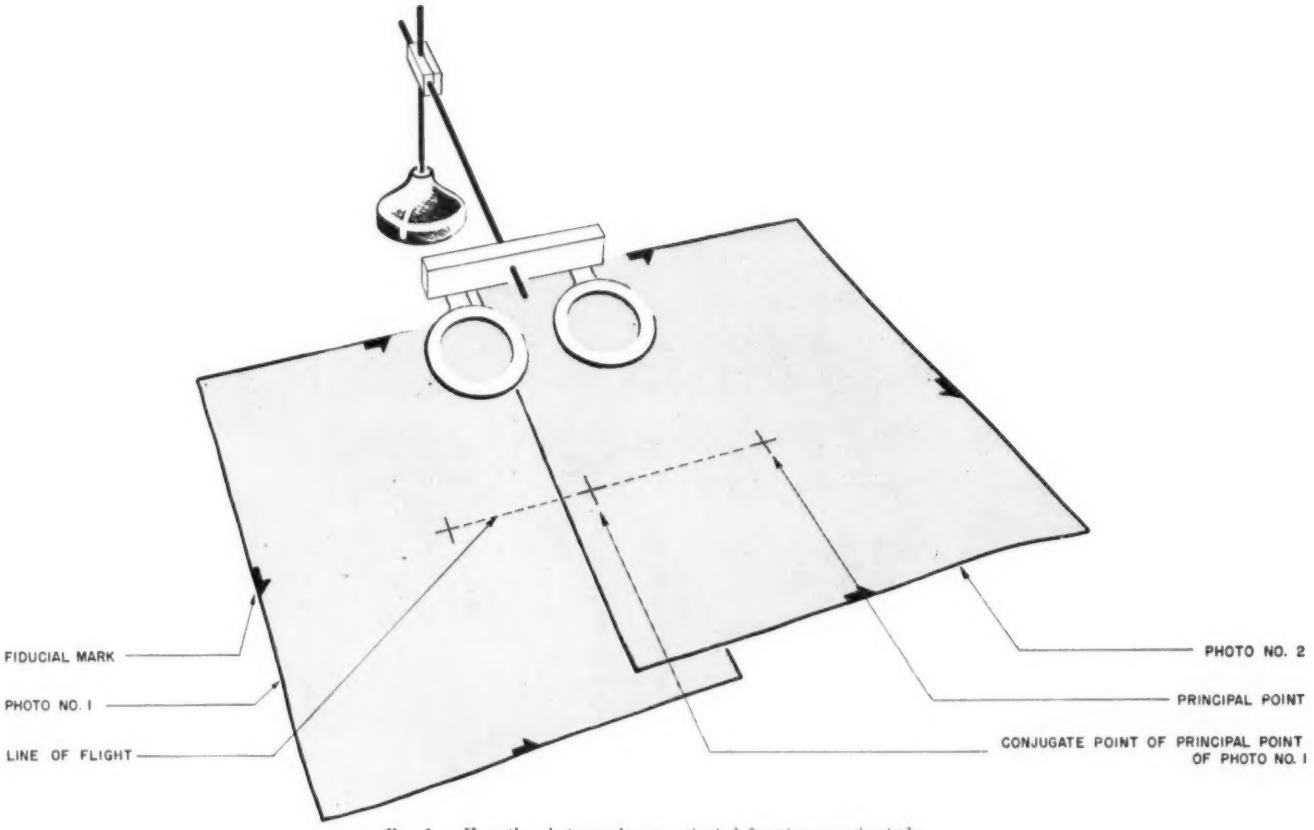

Fig. 1.— How the photographs are oriented for stereoscopic study.

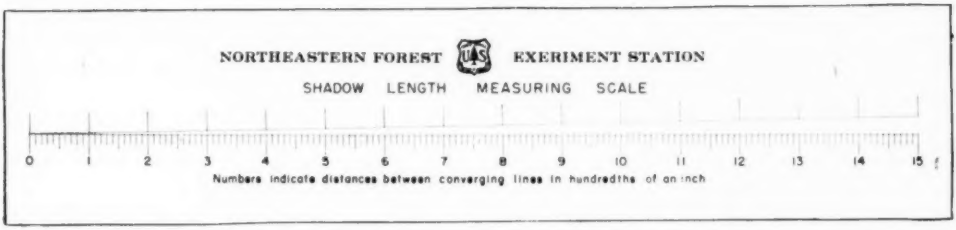
NORTHEASTERN FOREST EXERIMENT STATION
SHADOW LENGTH MEASURING SCALE
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Numbers indicate distances between converging lines in hundredths of an inch

FIG. 2.—Shadow wedge for measuring shadow length.

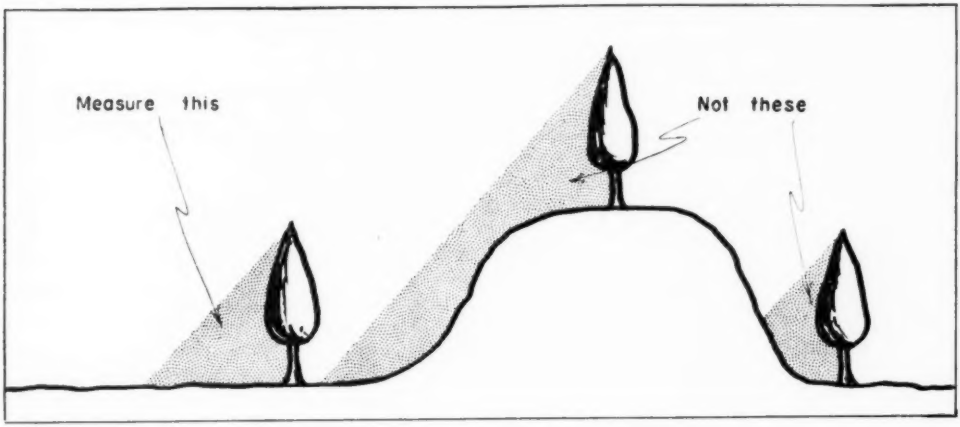

FIG. 3.—Slopes are tricky.

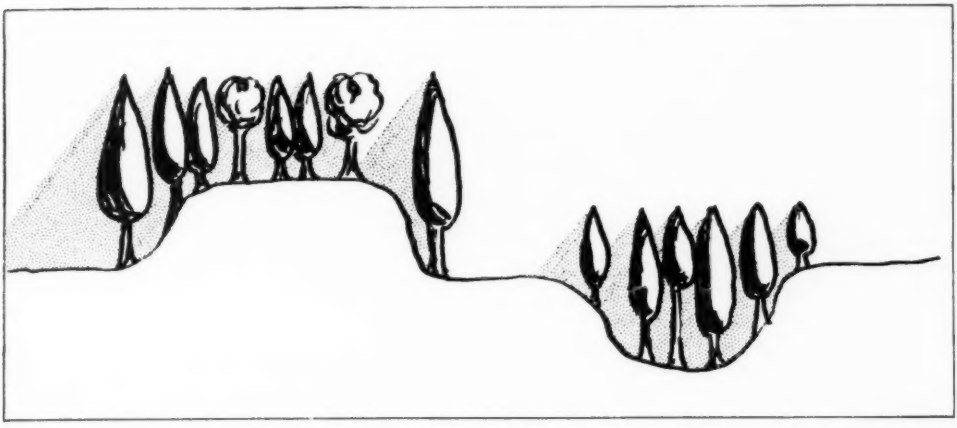

FIG. 4.—Gullies and knolls are hidden.

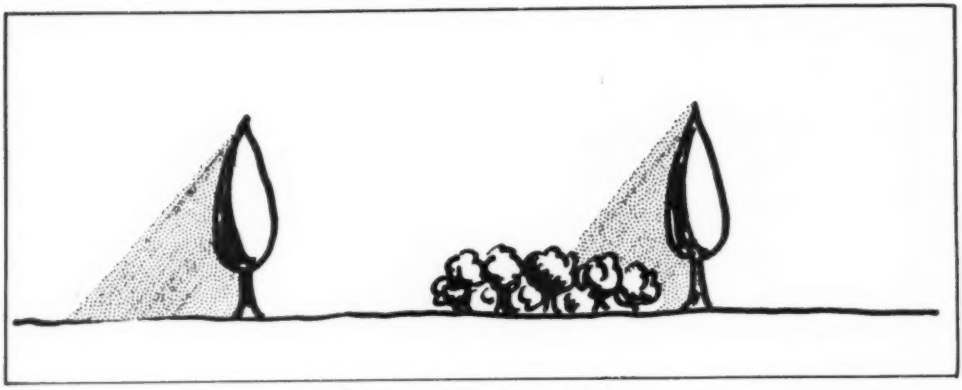

FIG. 5.—Underbrush shortens shadows.

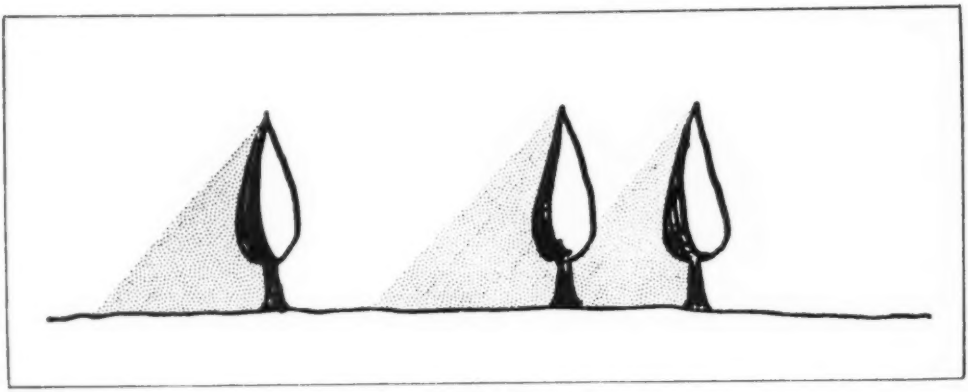

FIG. 6.—Interference shortens shadows.

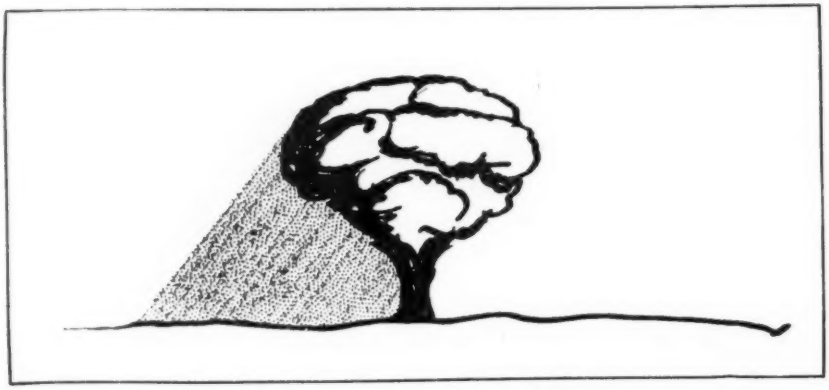

FIG. 7.—Large crowns lengthen shadows.

Large-crowned open-grown trees tend to have long shadows (Fig. 7). This is common in open old-growth forest. The shadow tip is produced by a side branch and not by the top of the tree, thus producing a long shadow.

Leaning trees are not a serious source of error because most trees are comparatively straight (Fig. 8). Shadows of trees leaning toward the sun are generally shortened, and height is apt to be underestimated. Shadows of trees leaning away from the sun tend to be lengthened slightly.

Care is needed in studying tree shadows near the edges of aerial photos. An aerial photo does not show a tree image in a true vertical projection except near the center of the photo, and the taller the tree, the greater the displacement.

A tree's shadow is measured from the base of the tree to the tree tip. Since the base is not visible on aerial photos, the location of the tree base is figured to near the center of the crown. This causes serious errors in measuring shadows of trees near the edges of the photo. When the tree image is displaced toward the shadow (Fig. 9, *A, B, C*) there is a tendency to underestimate.

Converting Shadow Length to Tree Height

Shadow length can be converted to tree height readily through the use of graphs[3] (Fig. 10). Such graphs may be prepared for any area and are necessary only for each two degrees of latitude. Only four items are required: The geographic location of the area, the time of day photographs were made, the date, and the photo scale. The following steps outline the use of the graph.

1. Locate nearest longitude and latitude of the area photographed. This can be determined from local maps.

2. Select the graph corresponding to the nearest latitude. Graphs are constructed for each two degrees of latitude.

3. Estimate the mean time. On longitudes 75°, 90°, 105°, and 120° the mean time is the same as the standard time. For geographic areas either side of these longitudes, add 4 minutes to standard time for each degree of longitude to the east and subtract 4 minutes for each degree of longitude to the west.

4. On the graph sheet the coordinate corresponding to mean time and read up to the date photo was made, interpolating where necessary. At this intersection, read over to the scale on the left and find the tree height. This is the tree height in feet for each 0.01 of an inch of tree shadow measured on a photo whose scale is 1:20,000.

5. For other photo scales, the tree height in

[3]The graphical solution of the astronomic triangle to obtain tree heights is based upon several assumptions:
1. That the declination of the sun for a given time is the same for all years.
2. That the declination of the sun for a given time in the spring months (January-May) and the corresponding fall months (July-November) is the same.
3. That the declination of the sun at noon of any given day is the same through that day.
4. That the equation of time corrections are the same for all years.
5. That computations for a given latitude are the same for plus or minus 1 degree of that latitude.
6. That computations for a given time longitude, 75°, 90°, 105°, etc., are the same for all time longitudes.
7. That interpolations for dates other than the 21st day at noon of each month are proportional to the lapse of time between the days of computations.

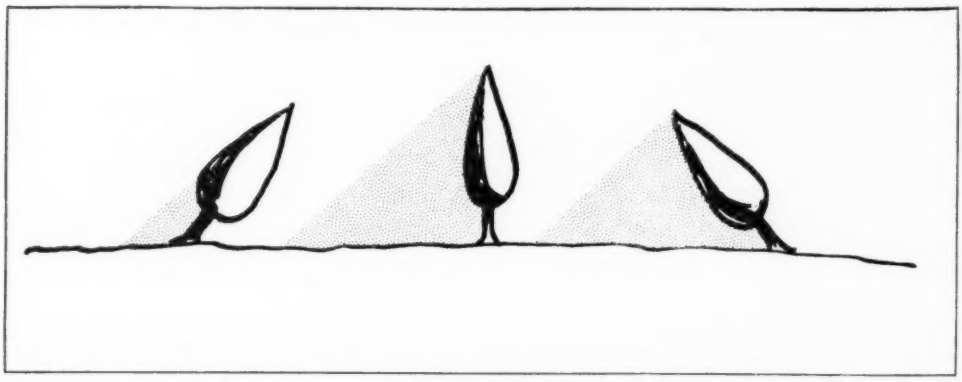

FIG. 8.—Leaning trees cast shadows longer or shorter than those of straight trees.

feet for 0.01 of an inch of shadow is directly proportional to the change of scale.

Example.—Given an aerial photo exposed at 3:30 p.m., EST, Sept. 10, 1942. Scale 1:10,000; latitude 42° N., longitude 80° W. What is the conversion factor—tree height in feet for each 0.01 inch of shadow?

Solution:

Standard time	3:30 p.m.
Subtract 4 minutes for each degree west of longitude 75°	-20
Mean time	3:10 p.m.
Select the 42° N latitude graph (fig. 10). From this, tree height for 0.01 inch of shadow at 3:10 p.m. on Sept. 10 is	10.5 feet
Correct for scale difference $\frac{10,000}{20,000}$	x 0.5
Tree height for each 0.01 inch of shadow measured on aerial photo	5.25 feet

Thus, if a tree shadow reads 10.3 on the wedge, then the tree height is 5.25 times 10.3 or 54 feet.

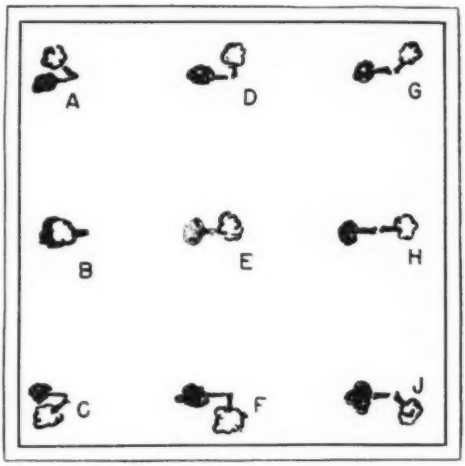

FIG. 9.—Images near edges of the photo are displaced.

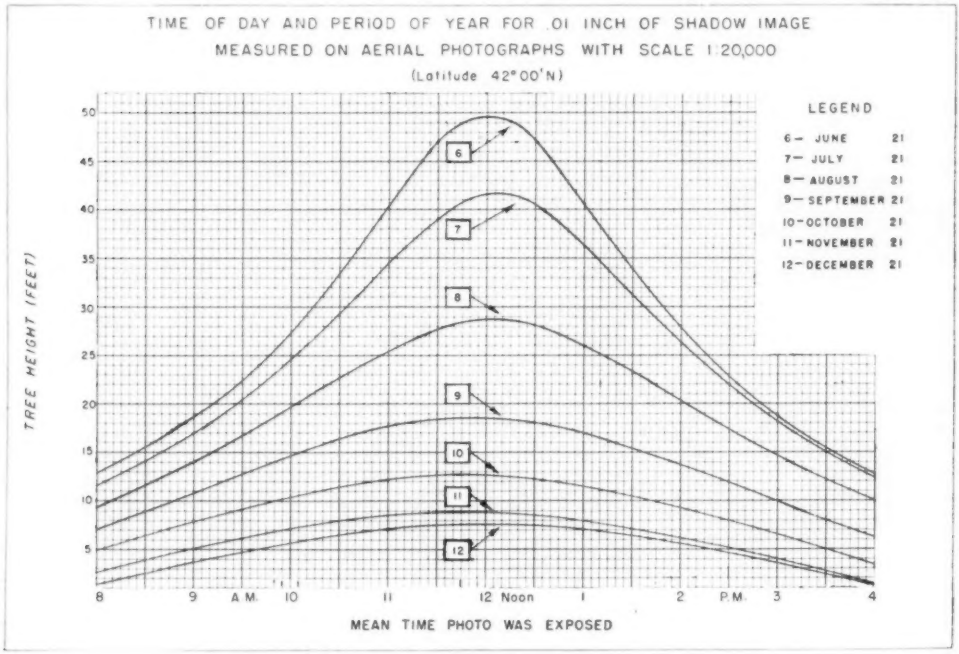

FIG. 10.—Graph for photos taken from June 21 to December 21.

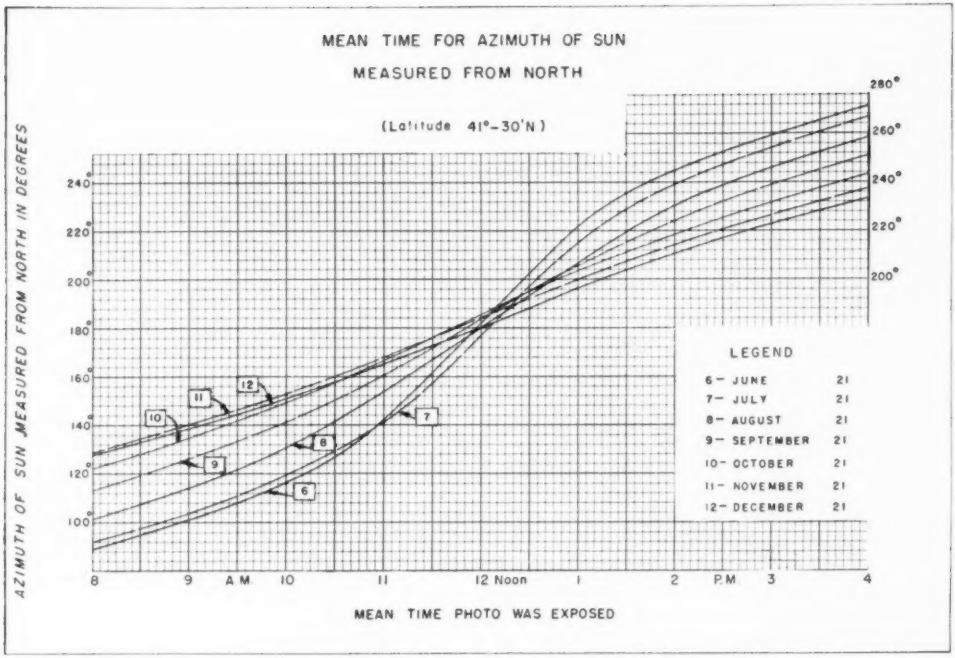
MEAN TIME FOR AZIMUTH OF SUN
MEASURED FROM NORTH
(Latitude 41°-30'N.)
AZIMUTH OF SUN MEASURED FROM NORTH IN DEGREES
MEAN TIME PHOTO WAS EXPOSED
8 9 A.M. 10 11 12 Noon 1 2 P.M. 3 4
100° 120° 140° 160° 180° 200° 220° 240°
200° 220° 240° 260° 280°
LEGEND
6- JUNE 21
7- JULY 21
8- AUGUST 21
9- SEPTEMBER 21
10- OCTOBER 21
11- NOVEMBER 21
12- DECEMBER 21

FIG. 11.—Type of graph used to estimate time photo was exposed. Graph is for period June 21 to December 21, for six degrees latitude (38°30'-44°30'), and all longitudes.

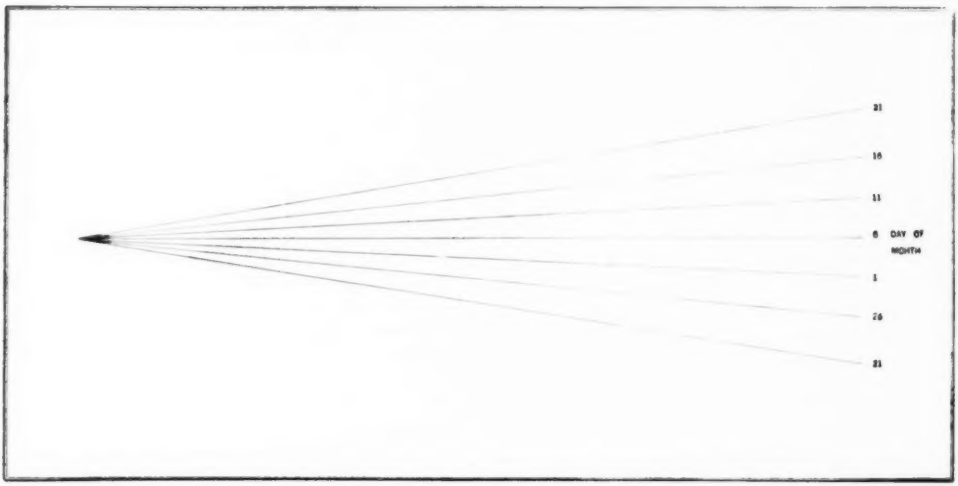

FIG. 12.—Wedge for interpolating date.

Time of Photo Exposure

The time of photo exposure is recorded on the contact print of the first and last photos in any flight. If, however, time records are lacking or inadequate, a graphical solution of the sun-dial formula (Fig. 11) can be used to estimate the mean time of photo exposure. The following steps are necessary:

1. With the aid of local maps, orient the photo and draw a true north-south line on it.
2. Also, draw a line parallel to the shadows on the photo so that this line will intersect the north-south line.
3. Measure the angle of intersection clockwise from north to the nearest degree. This angle is the azimuth of the sun's position from north.
4. From the graph. Fig. 11) select the coordinate corresponding to this azimuth. Read to the right to the date the photo was made, interpolating where necessary. Read down to find the time the photograph was made.
5. This time is the standard time for the longitudes, 75°, 90°, etc., and the mean time for other longitudes. Therefore, the time determined from Figuer 11 corresponds to mean time used in Figure 10.

The same assumptions are made for calculations in Figure 11 as were made for the calculations in Figure 10.

Aid to Date Interpolation on Graphs

The interpolation of the date on the two graphs (Fig. 10 and Fig. 11) may be facilitated by the use of a special device (Fig. 12). This device can be reproduced on glass plates or celluloid. It is used as follows:

1. On the desired time coordinate, locate points on each of the two curves between which the date falls.
2. Place the outside lines of the device (marked "21") over these two points. The outside lines should coincide with the curves at the points located.
3. Interpolate the date corresponding to the date photos were made. Read the tree height at that point.

Scale of Vertical Aerial Photograph

A vertical aerial photograph seldom has a constant scale. Its scale will vary with two factors: The amount of camera tilt from vertical and the amount of ground relief photographed. Present techniques of taking aerial photographs maintain a near-vertical position of the camera, which will cause only slight changes of scale. Therefore, it is thought that this effect on scale is not sufficiently serious to discuss here. But, changes in ground relief are serious and require further elaboration on their effect on scale.

An approximate photo scale is indicated on the photos or on the photo index mosaics. By the use of this scale tree heights within 10 feet, two times out of three, may be estimated for photo scales of about 1:20,000. To improve the scale control, the following methods are suggested:

For Flat Terrain

If the ground is flat or nearly so, the scale of a photo may be determined from one line.

$$\text{R.F., representative fraction} = \frac{\text{Photo distance}}{\text{Ground distance}} = \frac{g_1 g_2}{G_1 G_2} = \frac{d}{D}$$

Thus, if the distance between two points on the photo is 0.49 feet and the scaled ground distance from a map between the same two points is 10,800 feet, then the

$$\text{R.F.,} = \frac{0.49}{10{,}800} = \frac{1}{22{,}041} \text{ or } 1:22{,}041$$

This scheme may be used for forest survey of large areas in flat terrain. The average scale for a photo project should be calculated from about 10 control lines scattered at random.

For Rough Terrain

If the ground is rugged, the photo scale will vary with change of elevation. For such photos, the scale is calculated from one line and the ground elevation at each end of the line.

1. Calculate the approximate flying height:[4]

$$(H) = \frac{Df}{d} + \frac{hG_1 + hG_2}{2} \text{ where,}$$

(H) = Approximate flying height above sea level, in feet
D = Ground distance between ground points G_1 and G_2 *in feet*
d = Photo distance between G_1 and G_2, in feet
f = Focal length of camera lens, in feet
hG_1 = Elevation of point G_1 above sea level, in feet
hG_2 = Elevation of point G_2 above sea level, in feet

2. Then, using flying height, photo scale at the point of interest (G_3) is calculated:

$$R.F. = \frac{f}{(H) - hG_3} \text{ where,}$$

(H) = Approximate flying height above sea level, in feet
hG_3 = Elevation of the ground above sea level at point of interest obtained from topographic map, in feet
f = Focal length of camera lens, in feet

[4] Church, Earl F. Elements of photogrammetry. 95 pp., illus. Syracuse, N. Y. 1944.

Suppose scale is desired for a point (${}^{h}G_3$) whose elevation is 2,840 feet above sea level. The distance between two points on the photo is 0.49 feet (d) and the corresponding ground distance is 10,800 feet (D). The elevations of these points are 490 (${}^{h}G_1$) and 595 (${}^{h}G_2$). The focal length of camera lens is 0.6875 feet. The approximate flying height above sea level (H) is:

$$(H) = \frac{Df}{d} + \frac{{}^{h}G_1 + {}^{h}G_2}{2}$$

$$= \frac{(10{,}800)(.6857)}{.49} + \frac{490 + 595}{2} = 15{,}695 \text{ feet}$$

Scale for the point of interest (${}^{h}G_3$) is:

$$R.F. = \frac{f}{(H) - {}^{h}G_3} = \frac{.6875}{15{,}695 - 2840} = \frac{1}{18{,}698} = 1{:}18{,}698$$

Remeasurement of Twenty-five Year Old Plots

In 1923 six one-acre plots were established on lands of Finch-Pruyn and Company in the Central Adirondacks. Due to various causes, only two of these plots are extant. These two have been remeasured every five years—the last measurement in October, 1948 by Robert Whyland of the Company, John Curry of the U.S. Forest Service and the undersigned.

The plot on Fishing Brook in Township 20 is in softwood flat type cut in 1911. It is a thrifty stand of red and white spruce and balsam fir with hardwoods (chiefly soft maple and black cherry) and some white pine in mixture. The basal area (down to and including 4 inches dbh) of the spruce and fir was 22 square feet in 1923, equally divided between spruce and fir. In 1948 it is 70 square feet with spruce 28 and fir 42 square feet. The hardwoods and pines showed 29 square feet basal area in 1923. They now have 68 and, except for the pines, are decadent.

This plot now bears 17.20 cords of spruce and fir, rough; namely 6.90 spruce and 10.30 fir. This component is growing at 2 percent per year in volume or .3440 cords per acre. The fire is approaching overmaturity and could be cut to advantage. The cutting cycle is already 37 years.

The other remaining plot is on the Boreas River in Township 45, also in softwood flat type. When established in 1923 this was a dense softwood stand with a basal area for red spruce and fir of 119 square feet, preponderantly fir. The other species (chiefly cedar and birch) accounted for 44 square feet out of a total of 163 square feet.

Since 1923 and until 1943 the softwood basal area rose to 128 in 1928 (which was the culmination of the fir volume) and since then declined to 109 square feet in 1943, divided equally between spruce and fir. The "others" also declined to 26 square feet out of a 1943 total of 135 square feet. In other words, only the spruce showed a consistent gain.

In 1944 this plot was cut virtually clear, leaving only 7 square feet of basal area in the softwoods (6 for spruce and 1 for fir) out of a total of 25 square feet of which cedar was 13 and "others" 5 square feet.

There is a tremendous understory of the young softwoods—generally very thrifty. The remnant cedars and "others" are in poor condition.

These two plots will be remeasured in 1953. The data are filed with Finch-Pruyn & Company, Inc., in their Glens Falls, N. Y. office.

A. B. RECKNAGEL,
St. Regis Paper Co.

Use of the Helicopter for Sowing Mustard Seed in Burned Areas of Southern California

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Engineer on the Los Angeles River Flood Control Project, Angeles National Forest.

The helicopter demonstrates its versatility in still another forestry job, sowing mustard seed on the Angeles National Forest.

ANOTHER practical application of the helicopter to forest work has been demonstrated in the successful sowing of mustard seed in fire-denuded watersheds of southern California. Flying close to the ground in exceedingly rugged terrain, the helicopter performed well in broadcasting the seed evenly, with precision and speed. The helicopter proved itself to be an aircraft of high utility to foresters, beyond its previously reported uses for forest survey, fire control, and tree seeding.[1]

Since 1932 the U. S. Forest Service has sown common mustard (*Brassica nigra*) on watershed land recently denuded by fire in southern California. In this country of steep mountain slopes, loose and highly erosible soils, and heavy rainfall intensities, the burning of forest cover is usually followed by increased runoff, erosion, and flood damage. Moreover, the debris eroded from the burned areas often causes great losses by increasing the sedimentation rate of water storage reservoirs. The sowing of mustard is the best method developed to date for quickly providing a temporary plant cover in the recently burned areas to reduce the damages from accelerated runoff and erosion.

Of the 90,000 acres sown with mustard thus far, about one-half have been sown by hand and one-half by airplane.[2] By hand the seed distribution is good, but the job is slow and costly. By airplane the job is done quickly and at less than half the cost of hand sowing, but the operation is hazardous and the uniformity of seed distribution often leaves something to be desired. For this reason there has been a recognized need for a method of sowing that would combine the selectivity of hand work with the speed and lower cost of sowing by airplane.

In October, 1947 it was decided to test the helicopter's adaptability to this need. Fires on the Angeles National Forest that summer had burned an unusally rugged watershed, which required mustard sowing in a dozen separate areas. The terrain made sowing by airplane impractical. Sowing by hand would have been too slow. A helicopter designed and equipped for seeding was available,[3] and sowing mustard by helicopter appeared to be a promising method for trial.

The sowing was done in areas aggregating more than 1,000 acres. In Big Dalton Canyon, about 25 miles east of Los Angeles, 95 acres were sown in the Keril burn. In the rugged Big Tujunga Canyon, about 15 miles north of Los Angeles, 950 acres were sown in the Bryant burn.

The Keril burn covered moderately rugged topography typical of the San Gabriel Mountain front. Its elevation ranged from 1,716 feet above sea level at Big Dalton Dam to approximately 3,000 feet at the head of Keril Canyon. The area to be sown lay in one parcel, which simplified the problems of flying. This burn was sown first, so that the pilots could "feel their way" into the new experience of flying their aircraft very close to steep mountain slopes and canyon walls, as is required in sowing mustard.

The Bryant burn, by contrast, embraced some of the roughest topography in southern California—narrow, tortuous canyons; long slopes that often exceeded 100 percent gradient; and an altitudinal range of nearly 4,000 feet, from elevation 1,450 feet above sea level at the mouth of Big Tujunga Canyon to 5,439 feet at the

[1] Cruikshank, James W. The forest survey tests the helicopter. Jour. Forestry 45:878-883. 1947.

Jefferson, Frank J. The helicopter—a new factor in fire control. Fire Control Notes 9(1):1-9. 1948.

Kern, Jack C. Flying fire engines. Amer. Forests 54(5):208 ff. 1948.

Kern, Jack C. First extensive use of the helicopter in forest fire control. Jour. Forestry 46:487-492. 1948.

Olson, Harold. Seeding by helicopter. Amer. Forests 54(4):155. 1948.

[2] An additional 44,000 acres in two areas burned in 1948 have been sown with mustard since this article was submitted for publication. In both areas the helicopter was used effectively to sow the most rugged canyons, while the less broken topography was covered by faster sowing airplanes.

[3] A Bell helicopter, agricultural model 47B3, was used. The aircraft was owned and operated by Helicopter Services of California, a San Francisco concern.

summit of Condor Peak. Sowing was done in 11 separate parcels that ranged in size from 23 to 227 acres. This called for precision flying, and made the job exceedingly difficult.

Several test flights were made over level ground before the sowing was begun, to determine the width of swath sown and to obtain the proper concentration of seed within the swath. Swath width and seed concentration vary with the size and weight of seed used, the design of the seed release mechanism, the speed of flight, and the height of the aircraft above ground. In test flights, the seed was caught on freshly varnished squares of wax paper laid 10 feet apart on the ground, on a line at right angles to the direction of flight. Seed counts on the wax papers showed the minimum effective width of swath to be 60 feet, with a 10-foot "overlap zone" on each side. The rate of seed flow was adjusted to give the proper average concentration of 20 seeds per square foot. The optimum flying speed was found to be 30 miles per hour, and the optimum sowing height was approximately 50 feet above the ground.

An operations base was established in or near each burned area at low elevation, so as to gain the benefit of maximum air density for taking off with a load. Neither base required special preparation for use. The base in Big Dalton Canyon was located among the buildings of an old CCC camp at an elevation of 1,100 feet above sea level. The Big Tujunga base was an open plot of ground in a canyon bottom beside the road at elevation 1,775 feet.

Seed and gasoline were loaded at the operations bases, but landings were made elsewhere in the burned areas as desired to check seed distribution and confer with ground observers. Such landings were made at elevations up to 4,075 feet.

Two pilots and one mechanic were assigned to the job by the flying contractor. Pilots Harry Mitchell and James Thomas were experienced in helicopter operation os timber surveys, seeding, and crop dusting. Mechanic Edward Schieder made the adjustments necessary to obtain the correct rate of sowing, and handled helicopter maintenance and inspection on the job.

The pilots flew alternately so that they could compare notes on ground and air aspects of the flying, and relax between trips. Relaxation was found to be important because of the strain of maneuvering close to the ground in such rugged terrain. The pilot was the only person in the helicopter on sowing flights.

The Forest Service ground crew consisted of a project leader, three men to check distribution of seed in the burned areas, a tank truck and operator to stand by at the operations base for possible fire suppression, and two men to load the mustard seed into the aircraft hoppers.

Sowing was done largely on contour, starting at the top of a sowing area and working downward. A few trial flights both up and down the slope and on contour showed that flying on contour was better because of more uniform power requirements, easier maneuvering, and reduced pilot fatigue. Flying on contour also permitted ground observers to anticipate the direction of future flights, thereby helping them to get in the proper position for counting seed. The sowing was done in 8½ hours flying time, for an average rate of approximately 125 acres per hour.

Flying slowly and close to the ground, the pilot maneuvered with ease, made unhurried decisions as to the best coverage of changing topography, and oriented himself by ground landmarks such as rocks and trees. Moreover, the helicopter's ability to make sharp turns at the ends of sowing swaths avoided wide sweeps and the attendant loss of time and difficulty of reorientation. Because of this close control of flight, together with unrestricted visibility from the cockpit, it was found possible for the pilot to spread seed uniformly without the aid of ground flagmen. Dispensing with flagmen simplified the job and reduced its cost.

In the Big Tujunga burn, where 11 separate areas bounded by natural topographic features had to be flown, it was found best to have a forester make a reconnaissance flight with the pilot over each individual area just before sowing it. The forester pointed out the sowing area boundaries and gave any special instructions needed for the sowing of partially burned areas. The helicopter then returned to the base, dropped the forester, took on seed, and sowed the area. In this way the details of each area were fresh in the pilot's mind at the time of sowing, and no boundary markers were required on the ground. Dispensing with ground markers made a further saving in job cost.

Radio communication was tried but found unnecessary on the Big Dalton and Big Tujunga jobs. The pilot simply landed at suitable spots in the sown area and got first-hand reports on

the seed density and distribution. Close coordination was also maintained with the operations base, to which the pilot returned every 20 or 30 minutes to load more seed. Had it been necessary for the ground observers to advise the pilot of a large "missed" area, or of too light or too heavy sowing when a landing could not be made, they could have used a pre-arranged code of arm signals.

On large sowing projects of several thousand acres, however, radio would probably help in coordinating the work. It would be especially useful on jobs done by helicopters and airplanes working together.

The helicopter's performance surpassed expectations. Although its payload was limited to about 300 pounds of seed, enough for approximately 100 acres, it did the job with ease and efficiency. It distributed the seed uniformly and sowed a large part of the Big Tujunga burn under low clouds that would have grounded a conventional airplane. It was able to land at unprepared spots such as ridge tops and flats, a feature that facilitated the work and increased its safety. No difficulty was experienced in taking off, flying, or landing at the elevations encountered. On one trip in still air the helicopter flew with ease over the summit of Condor Peak (elevation 5,439 feet) carrying a load of 280 pounds of seed.

Ground examinations of the sown areas, made while the mustard was in flower in the spring of 1948, confirmed the excellence of initial seed distribution, which has been equalled only by the most careful hand sowing.

The factory-designed seedhoppers and seed release mechanism with which the helicopter was equipped functioned well. An electric switch on the pilot's control stick gave positive control of the seed gates. This positive control over seed flow, together with good visibility from the pilot's seat, made it possible to save seed by skipping small brushy or rocky areas that did not require sowing. Moreover, the seed gate was so designed that seed flow started instantly at the pre-determined optimum rate, without the waste from a sudden, concentrated burst of seed that has been noted with some seed hoppers.

The total cost of sowing mustard on this first job by helicopter was approximately $2.78 per acre, including the flying, seed, ground labor, automobile milage, and incidentals. This figure is high because of the contract cost of $1.59 an acre for the flying alone. However, a bid was received subsequently on a second 1,000-acre sowing job at the rate of only $0.78 an acre for the flying by helicopter. This bid was made in competition with the airplane, by which the job was actually done at $0.73 an acre. Both the helicopter and airplane bids were submitted by operators experienced in mustard sowing work. On the basis of these bids, the full cost of mustard sowing (including overhead) in December 1947 would have been $1.84 an acre by helicopter and $1.82 an acre by airplane, about one-half the cost of sowing by hand. The rate of sowing by helicopter was much faster than by hand, although slower than by airplane.

From the experience on these jobs, the helicopter is regarded as the safest type of aircraft for sowing mustard in rough mountainous areas. The slow flying speed that is possible only with the helicopter contributes materially to safety, particularly when the aircraft must fly close to the ground in mountainous terrain. In event of engine failure the helicopter can be landed without power, using the parachute effect of the rotating wing as it is kept in motion by air pressure in the descent (autorotation). This characteristic adds greatly to the helicopter's safety features in rugged terrain. The airplane, on the other hand, must have rapid forward speed in order to fly, which makes landing extremely hazardous if the engine fails in mountain areas.

The helicopter and the airplane should make an admirable team for sowing very large areas broken up by patches of steep terrain. The helicopter also appears especially well-adapted to jobs that require high selectivity in the areas to be sown.

The excellent performance of the helicopter on this difficult flying assignment gives the promise of wide usefulness for rotary-wing aircraft in other types of forest work. In the small helicopters commercially available today the forester can cruise slowly just above his work, or even hover motionless in mid-air, and then alight nearby for ground observations up to altitudes of 5,000 to 6,000 feet under average flying conditions. Higher altitudes can be reached under better flying conditions. Increased hovering, takeoff, and landing ability at higher altitudes, and greater load-carrying capacity, are to be expected of future helicopters. However, the models now in commerical production will perform satisfactorily for service in most lines of forest work.

Because of its unique flying characteristics, the helicopter fills a big transportation gap between the automobile and the airplane. A rapid expansion in its use for forest work is anticipated as more machines and adequately trained pilots become available—including additional assignments for sowing mustard seed in the burned-over watersheds of southern California.

Abstract of Thesis

A Study of Forage Volume Sampling on Grassland Range. By Charles E. Poulton. 65 pages, 16 tables, 11 figures. School of Forestry, University of Idaho, Moscow. 1948.

THE need for improved forage yield inventory methods is developed. A critical review of forage inventory methodology is made. The literature on factors important in herbage sampling is reviewed as a background for the main body of the paper.

A square ten-acre study area was laid out in a protected segment of Montana foothill range dominated by *Festuca idahoensis, Agropyron smithii, A. spicatum, Astragalus* sp., and *Lupinus flexuosus.* The observational unit consisted of a circular plot 14.86 inches in radius, 4.8 square feet in area, on which five grams yield per plot is equivalent to one-hundred pounds of herbage yield per acre.

The five most abundant species constituted fifty-eight percent of the cover and accounted for ninety-three percent of the yield. This suggests that the accuracy of final carrying capacity determinations is not adversely affected when minor species are disregarded in determining composition. Analysis of the species composition data indicates that sub-types are generally evidenced by a shift in dominance. Herbage yields are significantly affected only when the shift involves species of different growth form. This emphasizes the fact that present subjectives methods of delimiting plant communities may not always define individual yield populations with sufficient accuracy for intensive studies.

Data are presented which indicate that type variability is not directly related to the size of area sampled. Since required sampling intensity is determined by variability, this characteristic of the defined population—not total area as popularly supposed—is the major determinant of sampling intensity. Apparent variability is most strongly influenced by the degree to which individual populations are delimited. For volume yield inventory, accuracy of twenty percent at the ninety-five percent probability level is considered adequate. The number of plots required to obtain this level of accuracy was found to be seventeen for the two major sub-types and fourteen for the least variable subtype on the study area. Only twenty-five plots were required when all sub-types were lumped into one population. This indicates the importance of economic considerations in determining sub-typing intensity.

A procedure is suggested for converting herbage yield estimates to an estimate of carrying capacity. Recommendations for further study and development of the method are included.

Membranous Substances in Common Heartwoods

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IN THE change of sapwood into heartwood, the heartwood structure becomes infiltrated with a variety of substances such as resins, gums, tannins, and dyestuffs. Such infiltrated materials are generally classified as "secondary components of wood," or "extraneous substances." These terms are often used synonymously with the term "extractives," but in the case of heartwoods they are by no means completely extractable with inert solvents. For example, Douglas-fir heartwood, when exhaustively extracted with a variety of organic solvents (hydrocarbons, alcohols, ketones, etc.), still retains most of its orange color, which indicates that the substance responsible for the color has not been removed.

In some cases secondary substances may accumulate in the cell cavities (principally in the medullary rays) in the form of amorphous deposits readily visible under the microscope. The ray cells of western hemlock heartwood usually contain such deposits in the form of droplets and of short columns terminated by concave menisci as shown in Figure 1, A. These deposits are not extractable by inert solvents, but, as demonstrated by work done a number of years ago,[1] they swell enormously when the wood section is boiled a short time in dilute aqueous sodium hydroxide (Fig. 1, B). When tangential sections (in which the rays are cut transversely at short intervals to give free access to the reagent) are used, the deposits first swell and then dissolve.

Means have been found to isolate such deposits from the wood. The material separated from western hemlock is shown in Figure 1, C. It is apparent that a film of the material connects the larger aggregates and completely lines the interior of the ray cells, and extends into the connecting pits of the fiber and effectively seals off the cell cavity. These liners are pale orange in color under the microscope and reddish brown en masse.

The heartwood of certain other species contains similar deposits. Figure 1, D, shows those from Douglas-fir. Droplets and columns are much less in evidence than in western hemlock, but every ray appears to be lined with the membranous substance. It is these membranous substances that are chiefly responsible for the orange hue of this heartwood. Spruce heartwood (some specimens at least) yields ray-cell deposits, as shown in Figure 2, A. They are obtained in very much smaller quantity than from western hemlock and Douglas-fir, and are pale yellow rather than orange in color. Loblolly pine gave only a comparatively small amount of yellowish membranous substance, mostly smooth-walled. The liners from white pine consisted of thick deposits, presumably formed at the windowlike pits and held together by extremely fragile films (Fig. 2, B). Some hardwoods also were found to contain deposits. Blackjack oak heartwood yielded a copious amount of the material, as is shown in Figure 2, C.

As said above, the material in the ray cells of western hemlock heartwood may be swollen by boiling the wood section in dilute alkali. These deposits may be isolated after swelling, and then appear as in Figure 2, D.

Methods of Separating the Membranes

The methods of separating the deposits from the wood take advantage of the extreme resistance of these substances to acid reagents. The following four methods were successfully used with western hemlock heartwood:

1. The wood was delignified by heating with phenol containing a small amount of hydrogen chloride as a catalyst, and the resulting pulp was dissolved in 72 percent sulfuric acid or in cuprammonium solution. The deposits remained undissolved.

2. The cellulose and lignin were simultaneously dissolved in a solution of phenol in strong sulfuric acid, which left the deposits undissolved.

3. The wood substance (containing a little moisture) was dissolved away from the deposits with acetyl bromide.

4. The wood substance was dissolved much as described by Ross, Hill, and Potter in their

[1] Curran, C. E., E. R. Schafer, and J. C. Pew. A study of the color principle in western hemlock groundwood pulp. Paper Trade Jour. 101(8):35-41. 1935.

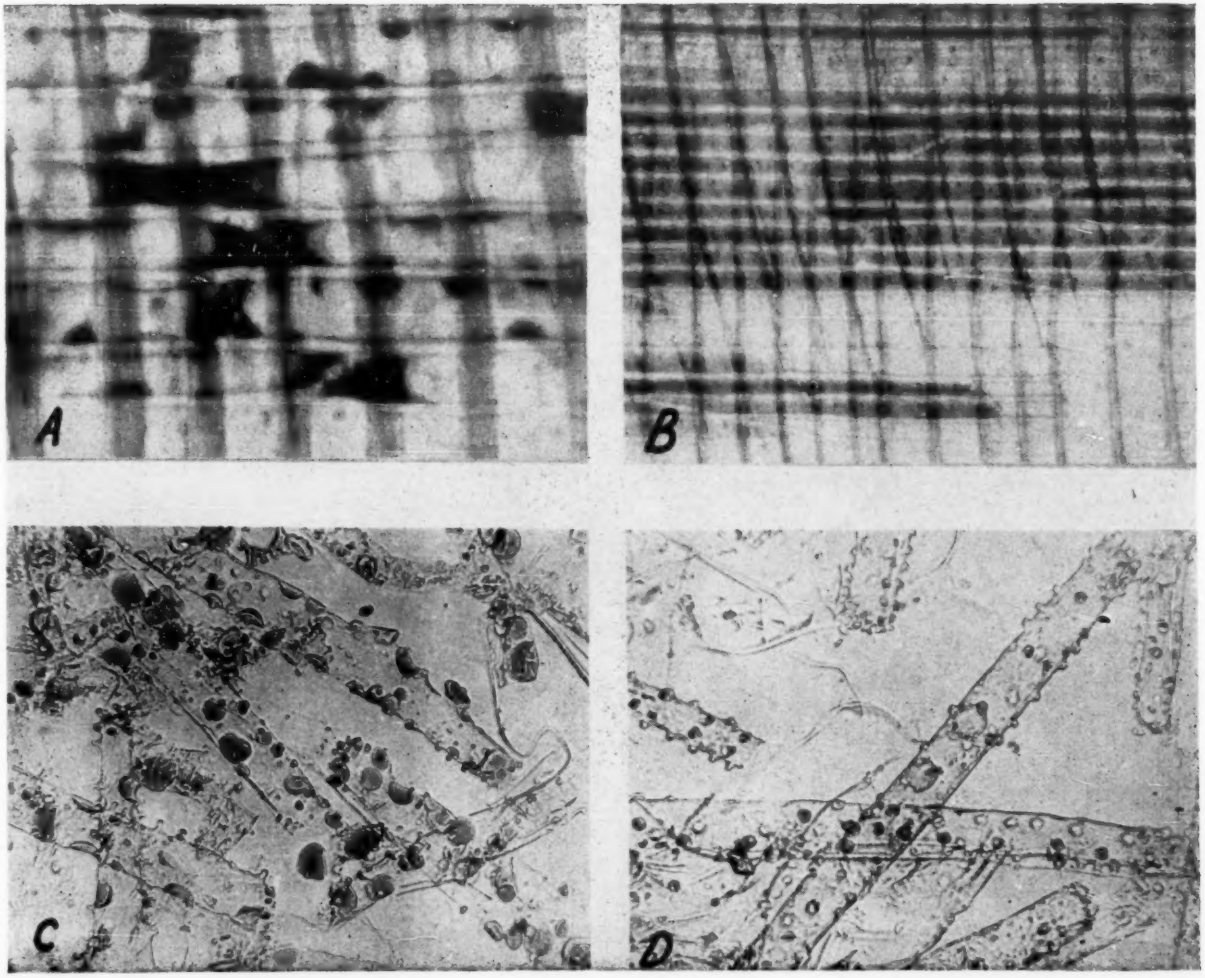

FIG. 1.—A, deposits in the ray cells of Western hemlock heartwood (X560); B, deposits in the ray cells of Western hemlock heartwood swollen with dilute aqueous sodium hydroxide (X200); C, ray-cell deposits isolated from Western hemlock heartwood (X420); and D, ray-cell deposits isolated from Douglas-fir heartwood (X420).

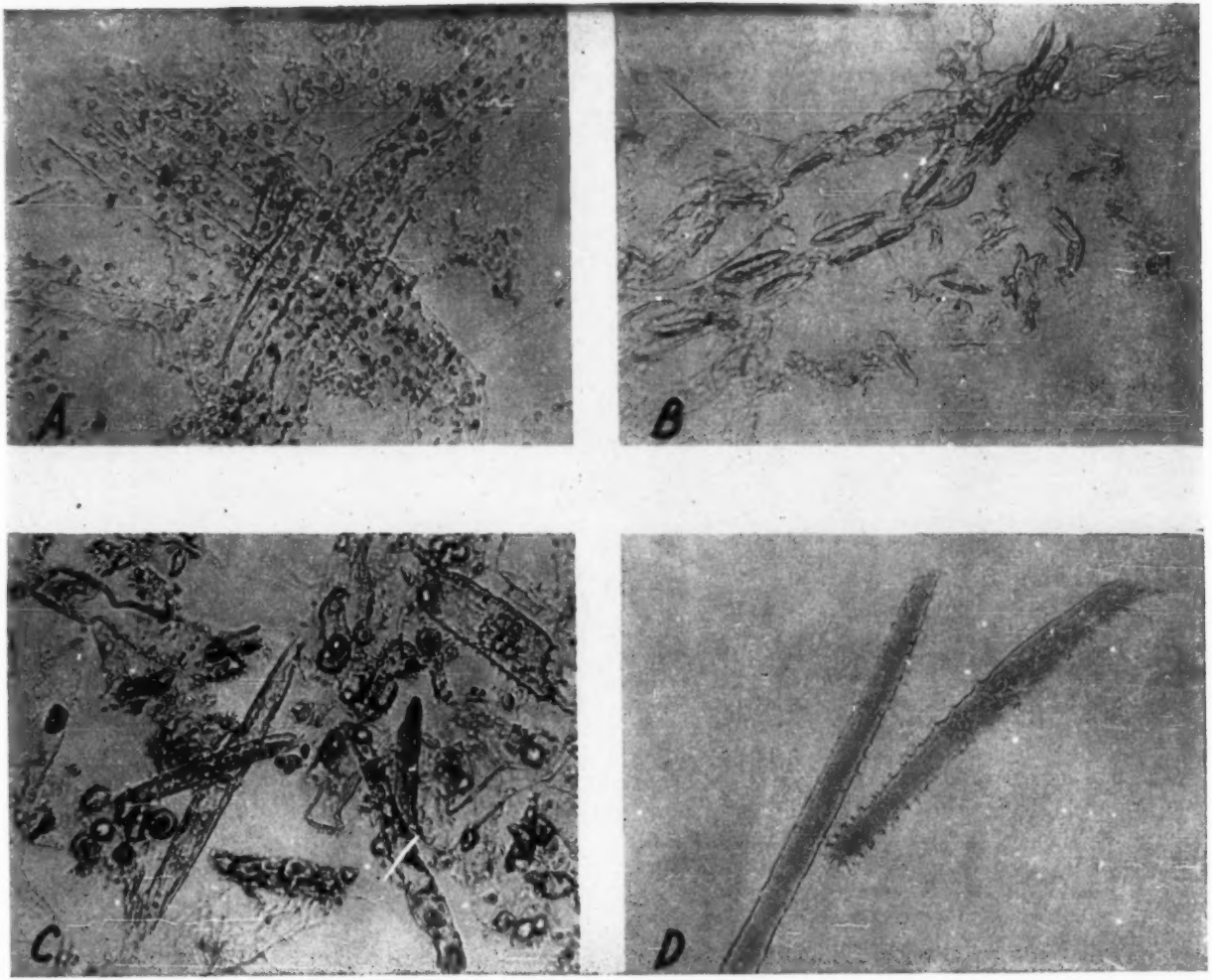

FIG. 2.—A, ray-cell deposits isolated from white spruce heartwood (X420); B, from white pine heartwood (X420); C, from blackjack oak heartwood (X420); and D, from Western hemlock heartwood after swelling (X420).

method for lignin determination.[2]

The fourth method proved to be a convenient procedure and, therefore, will be described in detail.

About 0.5 gram of air-dry radially cut shavings (made with a carpenter's plane) was moistened with 4 cubic centimeters of formalin and allowed to stand 5 minutes, after which 4 cubic centimeters of 72 percent sulfuric acid was stirred into the shavings. After the mixture stood 5 more minutes, 6 cubic centimeters of concentrated sulfuric acid was added, drop by drop, with stirring. After thorough stirring of the mixture, it was allowed to stand for 30 minutes. When a drop of the resulting reddish-brown solution was examined under the microscope, the deposits were readily visible. The deposits were found to be surprisingly resistant to this formaldehyde-sulfuric acid solution. Douglas-fir deposits were observed to be apparently unchanged in shape after standing in the reagent for a period of one month. After six months, the deposits were swollen, but the projections were still clearly visible.

[2]Potter, G. H. C., J. H. Ross, and F. H. Yorston. Estimation of lignin by the formaldehyde and sulfuric acid method. Forest Products Laboratories of Canada, Quart. Rev. No. 11, July-September. 1932.

In order to isolate the deposits, the acid solution was diluted with 100 cubic centimeters of a mixture of equal parts of acetone and cellosolve. On centrifuging this solution in a separatory funnel, the membranous substances settled, were drawn off, suspended in a fresh portion of the solvent, and again centrifuged. For microscopic study they were retained as a suspension in a small amount of the solvent.

The amount of deposits was determined only from a single sample of second-growth Douglas-fir heartwood. This sample yielded 0.91 percent deposits. Membrane-like substances were in no case observed with green sapwood of any of the species investigated, nor with green sapwood after rapid drying in air. The sapwood of a western hemlock log seasoned for a long time with the bark on, did, however, show fragmentary membranes. No evidence of membrane-like deposits being derived from the vertical tracheids in the various species tested was found.

The effect of the rather drastic methods of isolation on the chemical properties of the membraneous substances was not investigated in any detail, but it was observed that the deposits isolated from western hemlock by the formaldehyde-sulfuric acid method no longer swelled in hot dilute sodium hydroxide.

New Seed-Extraction Apparatus

A new departure in seed extraction is represented in the machine constructed by Dr. Werner Schmidt and Engineer Schuble of Frankfurt- am-Main, Germany. Curing sheds and dry kilns are eliminated entirely, with the attendant hazard of seed spoilage and heat injury. Instead, the machine macerates the cones by drawing the cone scales backward so that the seeds fall out. The seeds then pass through a de-winging machine and a cleaning mill in which the light seeds are sorted out. Freshly picked cones are poured in a hopper at the top and cleaned seeds emerge at the bottom. The percent of seeds injured is reported to be very small. No heat is used. Two hundred Norway spruce cones can be handled per hour, yielding 8 pounds clean seed. Enough seed can be produced in 10 hours to produce 1½ million 2-1 seedlings sufficient to plant over 1,000 acres. The machine is mounted on a truck, which can be driven into the forest where the cones have been picked, thus avoiding the expense of cone transport. Douglas-fir cones have already been successfully used in the machine, and it is expected that all kinds of conifers can be handled with minor adjustments. Plans have already been made to introduce the machine in the United States.

HENRY I. BALDWIN.

Silvicultural Treatment of Virgin Douglas-Fir Stands in the Southwest

Hermann Krauch

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From thirty-eight years' experience in silvicultural research in the Southwest the author sets forth principles to guide timber cutting in the Douglas-fir forests.

THE Douglas-fir forest type occurs in mountain ranges that are the main sources of irrigation and domestic water supplies of the populated semi-arid lowlands of the Southwest. The role it plays as a protective cover of watersheds constitutes its most important function. It also serves as a natural environment for wildlife and is extensively used for recreation. Silvicultural treatment of this forest type must improve these values. Of particular concern to forest administrators is the way in which virgin stands should be cut. Many stands contain large numbers of trees that have matured long ago. If these are not cut they will eventually die and be a complete loss. Thus the advisability of removing them is indicated. Cuttings are made to obtain utilizable wood and also to release young trees and create conditions that will favor the establishment of new seedlings. Cutting also affords the means whereby forest conditions may be improved with respect to quality of trees and species composition. It enables the creation of better environmental conditions for wildlife, recreation, and water yield.

Character of Virgin Douglas-fir Stands with Respect to Site

Methods of cutting depend on stand conditions, which differ with site. Before discussing these cutting methods it will be well to point out conditions that obtain with respect to "cool" sites and "warm" sites.

On cool sites, chiefly those with northerly and easterly slopes, Douglas-fir and its usual associate, white fir, are the predominating species. White fir frequently comprising as large or even a larger part of stands than Douglas-fir. Intermixed with these two prevailing species are varying amounts of Engelmann spruce, blue spruce, and limber pine. Occasionally, some ponderosa pine also occurs on these sites. Natural openings attributable to fire, insects, windthrow, and other agencies, are commonly occupied by aspen thickets. Some advance growth, chiefly white fir, is usually present under the canopy of the conifers. Where the stands are dense the seedlings are usually stunted—because of root competition and insufficient light. Where reproduction occurs under aspen it is usually thrifty and making good growth.

On warm sites (southerly and westerly slope aspects) the predominating species are Douglas-fir and ponderosa pine. Intermixed with these species are usually some limber pine and white fir. Spruce is rarely present. The stands, as a rule, occur in smaller groups with trees that stand farther apart than on cool sites. There are also usually much larger openings in the stands. These openings usually contain clumps of gambel oaks and sometimes small groups of aspen trees. Advance reproduction of Douglas-fir is frequently abundant on warm sites, especially under ponderosa pine, limber pine, gambel oak, and aspen. Occasionally some Douglas-fir seedlings occur under parent trees but as a rule only when a mat of pine needles or broadleaf tree litter from nearby trees of other species is present.

How Stands Should be Cut Depends on Objectives

Cutting always results in some disturbance of conditions essential to watershed protection. This applies especially to litter, the disturbance of which in the process of skidding logs may seriously impair the water-holding capacity of the soil. The heavier the cutting the greater is the disturbance of litter likely to be. Because of the danger of impairing watershed conditions, only light cutting seems permissible in most of the Douglas-fir type. How to cut depends on the species of tree (or trees) to which it is desired to have the lands stocked. Cutting in the Douglas-fir type may be presumed to have as one of its main objectives the creation of conditions that will favor restocking to Douglas-fir.

An understanding of successional stages that have led to the present stands will serve as a helpful guide in marking the stands for cutting.

On the cool sites Douglas-fir is the tree in the successional stage immediately preceding the climax in which white fir and spruce are the prevailing species. Therefore, if it is primarily Douglas-fir that is wanted, restocking to the climax species must be artificially controlled. This means that as many of the white fir and spruce trees as possible should be removed and most of the Douglas-fir trees reserved until reproduction has become established in the openings. Also, where individual aspen trees occur in virgin stands, these should also be cut to induce sprouts to spring from the roots, many of which will come up in the openings created by the cutting of fir and spruce trees. These aspen sprouts will supply needed shade to the new Douglas-fir seedlings. Limber pines should not be cut for they too will serve as excellent nurse trees for future crops of Douglas-fir seedlings.

On warm sites Douglas-fir is the climax species and, as was previously indicated, there is usually a considerable amount of advance reproduction present under the associated ponderosa and limber pines. Here the cutting policy should be to cut the older pines so as to release Douglas-fir seedlings. Younger pines should be reserved. Since on warm sites Douglas-fir reproduction becomes established in advance of cutting, mature trees of this species may be cut to a greater extent than on cool sites. The occasional white fir trees occurring on these sites should probably always be cut. Where there is Douglas fir reproduction present in oak clumps it might be advisable to cut the oak so that new sprouts may be induced to spring up in the adjacent unstocked areas to serve as a shelterwood for a new crop of Douglas-fir seedlings.

In actual practice cutting on the respective sites may depart considerably from what has just been suggested. Thus on cool sites where it has been suggested that cutting be confined primarily to white fir and spruce, it may, because of economic considerations, be necessary to cut some Douglas-fir trees as well. The cutting of these Douglas-firs may be desirable from a silvicultural standpoint. It might, for instance, be well to cut large mature trees where these are dominating a number of smaller and younger trees, thus releasing the latter so that they may grow at a faster rate. Decadent trees which do not contain sufficient volume to justify logging might, on the other hand, be left for seed, especially in locations where advance reproduction is lacking. After the establishment of a new crop of seedlings, decadent trees could perhaps be cut for converter pole material and firewood, or poisoned. Where thrifty mature trees are left for seed, these too should be cut as soon as possible after new seedlings have become established because, if this is not done, many of the seedlings will die and those that do survive will not develop properly.

Similar considerations apply with respect to cutting on warm sites, where it is not so much a matter of cutting to promote the establishment of Douglas-fir reproduction but to release seedlings already present. It may be desirable to have warm sites stocked to a considerable extent to ponderosa pine. Care should be taken to reserve ponderosa pine trees for seed where reproduction of this species is lacking or insufficient.

Advocating that only light cutting be practiced in the Douglas-fir type does not mean that a single light cut is all that is needed to bring about restocking. It does mean that only light cutting should be done at a particular time, to avoid too much disturbance of forest litter. Several light cuts may be necessary before the right conditions for reproduction establishment have been created. The number of cuts required will depend on what progress is being made in reproduction establishment.

Cutting in virgin stands should be designed not only to release advance growth and to create favorable conditions for the establishment of reproduction, but also to promote growth and yield. To accomplish the latter, tree groups should be thinned so that remaining trees will have more room to develop. In doing this, more consideration should be given to clearness of bole than to size of crown. As in the case of ponderosa pine, it has been found that trees with relatively small crowns will make good diameter growth after being released. This is true not only of younger trees but also of those that are approaching or have reached a mature age. The important thing is that the trees reserved should be healthy.

Distinguishing healthy from unhealthy trees is not always easy. Although crown condition serves as a guide, there are other factors to be considered. For instance, where trees stand in dense groups they frequently have rather thin crowns. This does not necessarily mean that the trees are unhealthy. The thinness of their

crowns may be due to competition for soil moisture of for light. The fact that many thin-crowned trees "thicken up" after being released shows that they are not always unhealthy. On the other hand, when trees have both thin and sickly looking crowns, it is usually an indication that they are definitely unhealthy.

Trees infected with mistletoe or rot, struck by lightning, fire-scarred, or attacked by insects are usually to be regarded as "unhealthy." Whether and to what extent a tree is infected with rot is sometimes difficult to determine. Rot may be suspected if the trees have dead tops, are badly fire-scarred, or have a number of dead branches. Condition of crown, on the other hand, is not indicative. Trees may be badly infected with rot, yet have thrifty crowns.

A factor, other than health, to be considered in deciding whether trees should be cut is their susceptibility to windthrow or wind breakage. Such susceptibility is partly dependent on the nature of the trees and their location, (as, for example, in places where there is an accumulation of water from melting snows or heavy rains). Thus, a tall tree, left exposed by cutting other members of a group, would be expected to be more subject to windthrow than a tall tree standing more or less by itself. Trees with very short crowns are likely to be broken off by the wind, especially if they have been long suppressed. Such trees are not likely to put on enough diameter growth, after being released, to warrant their retention.

How Cutting Can Create Better Conditions for Recreation, Wildlife, Water Yield

Cutting in virgin stands does not necessarily mar esthetic or recreation values. It may, in fact, be said to improve them, for it removes unsightly dead and declining trees. Even the forest shade is not impaired, under a system of light cutting.

Under some conditions it may be desirable to clear cut (except for seed trees). This would be true of areas that contain even-aged stands of trees that are mature and largely decadent. After cutting, such areas will grow up to stands of broadleaf species of trees and shrubs which will serve as both food and shelter for certain kinds of game, especially for deer and turkey. In time these temporary species will be replaced by conifers. If the cut-over areas are protected against heavy grazing by livestock no serious impairment of watershed values should result. A cover of broadleaf species is in fact believed to be more efficient from the standpoint of water conservation than a cover of coniferous trees. There is less interception of snow fall by trees that are leafless in winter.

Light cutting, as has been suggested for most of the virgin stands in the Douglas-fir types, should result in better conditions with respect to water yield, not primarily because reducing the number of trees means less water lost through transpiration, but rather because the openings created in the stands permit more rain and snow to enter the soil mantle. By cutting lightly the openings will be comparatively small and the surrounding trees will cast sufficient shade and litter to prevent excessive evaporation of moisture from the soil.

Silvicultural Principles Rather Than Rules Should be Basis for Marking

Can the principles discussed here be translated into a set of marking rules? If by marking rules is meant specifying how stands are to be marked with respect to sizes (diameter) and classes of trees to be removed, the answer is "No." Marking practice depends upon the conditions that obtain, and it has been shown that these vary considerably. It is believed that if the timber marker knows what the objectives are and understands governing silvicultural principles he will be able to mark correctly. Correct marking requires good judgment and this is something that many marking rules do not facilitate.

Following are a number of points to be kept in mind while marking stands for cutting:

1. For any single cutting mark only sufficient trees to supply the *minimum* volume required for an economic cut.

2. Since the aim should be not to create too large openings in the stands, bear in mind that the larger the tree the less is the amount of opening per unit of volume cut; also that there is less slash per unit of volume.

3. Do not mark trees simply because they are old. If thrifty, such trees will, after removal of nearby trees, resume growth at an accelerated rate.

4. Mark large trees if they are suppressing younger trees but do not mark them if they are needed for seed. Defective trees that do not contain sufficient volume to justify logging can, if necessary, be left for seed.

5. Do not mark clean-boled trees simply be-

cause they have short crowns. If the trees are thrifty such trees will resume growth when released.

6. To provide for better spacing of trees that occur in groups, mark some of them for cutting. Aim to reserve the best trees for further growth, namely those that have the cleanest boles.

7. Mark heaviest the species that are least desired, and mark lightest the species that are most desired.

8. In general, mark to release advance growth where this is present and to create conditions that will favor the establishment of reproduction where it is lacking or deficient.

Much Good Can Be Accomplished Through Proper Slash Disposal

Much in the way of silvicultural and other benefits can be obtained through proper disposal of logging slash. For instance, scattering of slash in natural openings or openings created by the cutting of trees should, through the partial shade the slash affords, promote the establishment of reproduction, especially of Douglas-fir which absolutely requires shade during the early stages of seedling development. The needles that fall from the slash will also supply some litter and thus help to conserve soil moisture. Where trees have been felled into large openings and no advance reproduction is present, the tops might well be left as they are, i.e., without removing the branches. In case no trees are felled directly into the openings it might be well to have the tops pulled into them. Where the skidding of logs is done with tractors it should be possible to dispose of much of the slash by running the tractor over it. By thus getting the slash imbedded it will not only effectively control erosion but will also cause considerable organic matter to be added to the soil.

It is recognized that fire, insect, and other hazards need to be considered and that, under some conditions, it may be best to pile and burn the slash. However, under light cutting, as has been recommended, these hazards would appear to be relatively small.

Young Trees Should be Artificially Pruned

Much in the way of improving the quality of timber to be cut in the future can be accomplished through pruning of young trees. It would seem especially desirable to prune open-grown trees for these cannot be expected to prune naturally, at least not for many years. Moreover, inasmuch as such trees already have well-developed root systems, pruning, even though done severely, will probably not materially affect diameter growth. Where trees occur in groups, those in the center frequently become fairly well pruned through natural means, whereas those on the outer edges continue to retain their branches just as open-growth trees do. It would seem desirable to prune these so-called "border trees" also.

The artificial pruning of trees will be found to be beneficial in still another respect, namely that by permitting more side light to enter the stands it will enhance the growth and development of the smaller seedlings that have become established in the vicinity of the pruned trees. Thinning of groups of young trees with the view of promoting diameter growth is not recommended unless the trees removed can be utilized.

Aerial Photo Alignment Guide

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Forest Survey, Central States Forest Experiment Station, Columbus, Ohio.

FORESTERS who use aerial photographs will be interested in a mechanical aid that helps to locate photo centers and to align photos of stereo pairs. Photo interpreters who determine tree heights or differences in elevation on aerial photographs by means of the Harvard parallax wedge must have the photos of each stereo pair exactly oriented, and with the centers an exact distance apart. Also, beginners in the stereoscopic use of aerial photographs often have difficulty in placing the photos of a stereo pair in such a position that optimum stereo vision results. The aerial photo alignment guide has been developed to assist the photo interpreter in properly orienting the stereo pair for measurements with the Harvard parallax wedge and to help the beginner orient photos for stereoscopic vision.

Construction

The construction of the photo alignment guide is a simple process. The only material needed is a 12- by 12-inch sheet of clear plastic 1/16 inch thick. Using a sharp instrument, such as a heavy needle, etch a straight line across the center of the sheet (Fig. 1). Next, etch a line perpendicular to the first, 4½ inches from one edge. At intersection A make a hole approximately 1/32-inch in diameter. This can be made by using a drill or by forcing a heated needle through the plastic. A thin plastic sheet with intersecting lines has been used by photogrammetrists to find the principal point (center) of photos.

To complete the alignment guide for use with the Harvard parallax wedge, make a second hole on the center line at B. The distance between points A and B on the alignment guide should be made equal to the average distance between the two divergent lines on the parallax wedge to be used. A number of holes can be made along the center line for use with different sizes of parallax wedge. Each hole should be identified with the particular wedge with which it is to be used.

To complete the alignment guide for beginner's use as an aid in placing the photos of a stereo pair in position for best stereo vision, mark in pencil on the center line the tentative position of the second hole at C. An average distance of 2.3 inches between points A and C serves for most people. A procedure for further adjusting for individual eye-differences of beginerns is explained in the next section.

Use

A few simple steps are stated here, to aid in the use of the alignment guide with the parallax wedge.

1. To find the center of any photo, place the alignment guide over it so that the two lines of the guide fall exactly on the points of the four arrows (fiducial marks) found on the photo edge. The center will be beneath intersection A.

2. Mark the center point of each photo of a stereo pair by pricking with a needle through the hole at A.

3. Transfer the center point of the first picture to the second and vice versa. For accurate work use the stereoscope in transferring these points.

4. Place the first photo in a fixed position on the table with a piece of tape.

5. Adjust the alignment guide over this photo until point A falls over the center point of the photo.

6. Rotate the guide until its center line passes over the center point of the second picture as shown on the first picture.

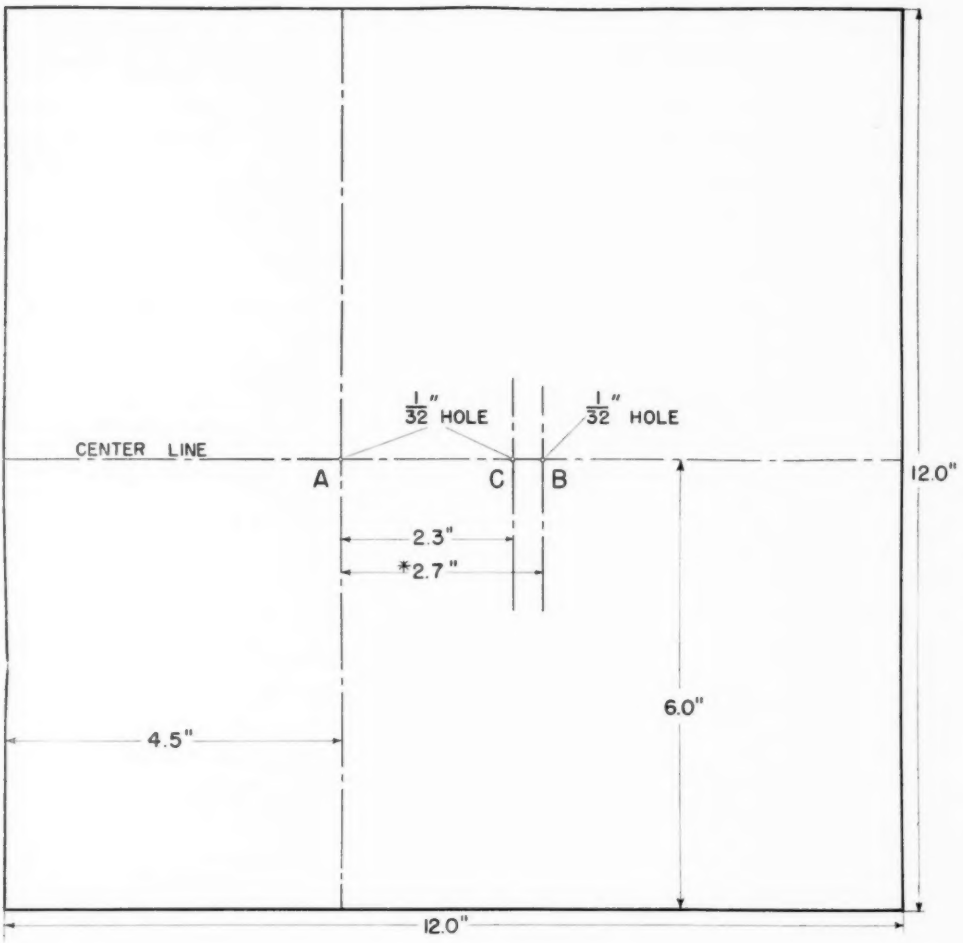
7. Hold the alignment guide firmly in position with one hand and with the other slip the second picture between the guide and the first picture.

8. Adjust the second picture until point B of the guide is over the center point of the first picture as it is shown on the second picture.

9. Rotate the second picture around point B until the center line of the guide passes over the center point of the second picture.

10. Fix the second picture in this position with a piece of tape. The photo centers are now properly spaced and properly oriented for making measurements with the parallax wedge.

Further adjustment of the guide to meet individual eye-differences of beginners is accomplished by finding the ultimate position of the tentative hole C. To make this adjustment proceed as in the above paragraph through step



MATERIAL— 1/16" CLEAR PLASTIC.

——— - ——— - ——— ETCHED LINES.

* DISTANCE VARIES BY WIDTH OF PARALLAX WEDGE USED.

FIG. 1.—Aerial photo alignment guide.

number six. As above, hold the alignment guide firmly in position over the first picture, and slip the second picture between the guide and the first picture. Adjust the second picture until the tentative point C, previously marked on the center line of the guide, is over the center point of the first picture as it is shown on the second picture. Rotate the second picture around this point until the center line of the guide passes over the center point of the second picture. Next, place the stereoscope over the guide and while looking through them and maintaining the orientation of the second photo move it left or right until the photo gives the best stereo vision. Mark on the guide the position of the center point of the first picture as it appears on the second picture. Drill a hole in the guide at this point, and label it ultimate point C.

To use the alignment guide to set up photos of a stereo pair for optimum stereo vision, substitute point C for B in the ten directions given above.

Cry, the Beloved Country[1]

"There is a lovely road that runs from Ixopo into the hills. These hills are grass-covered and rolling, and they are lovely beyond any singing of it. The road climbs seven miles into them, to Carisbrooke; and from there, if there is no mist, you look down on one of the fairest valleys of Africa. About you there is grass and bracken and you may hear the forlorn crying of the titihoya, one of the birds of the veld. Below you is the valley of the Umzimkulu, on its journey from the Drakensberg to the sea; and beyond and behind the river, great hill after great hill; and beyond and behind them, the mountains of Ingeli and East Griqualand.

"The grass is rich and matted, you cannot see the soil. It holds the rain and the mist, and they seep into the ground, feeding the streams in every kloof. It is well-tended, and not too many cattle feed upon it; not too many fires burn it, laying bare the soil. Stand unshod upon it, for the ground is holy, being even as it came from the Creator. Keep it, guard it, care for it, for it keeps men, guards men, cares for men. Destroy it and man is destroyed.

"Where you stand the grass is rich and matted, you cannot see the soil. But the rich green hills break down. They fall to the valley below, and falling, changes their nature. For they grow red and bare; they cannot hold the rain and mist, and the streams are dry in the kloofs. Too many cattle feed upon the grass, and too many fires have burned it. Stand upon it, for it is coarse and sharp, and the stones cut under the feet. It is not kept, or guarded, or cared for; it no longer keeps men, guards men, cares for men. The titihoya does not cry here any more.

"The great red hills stand desolate, and the earth has torn away like flesh. The lightning flashes over them, the clouds pour down upon them, the dead streams come to life, full of the red blood of the earth. Down in the valley women scratch the soil that is left, and the maize hardly reaches the height of a man. They are valleys of old men and old women, of mothers and children. The men are away, the young men and the girls are away. The soil cannot keep them any more."

Alan Paton's novel deals movingly with the moral decay that besets a native African family driven to the city because overgrazing had ruined their homeland. It closes with the high hope instilled in valley dwellers by a new farm conservation program.

H. L. S.

[1]Quoted from Chapter 1, *Cry, the Beloved Country* by Alan Paton. Charles Scribner's Sons, New York. 1948. With permission from the publishers.

Porcupines' Preferences in Pine Plantations

Paul O. Rudolf

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It is generally known that porcupines may cause heavy local damage in forest stands. Specific information on their choice of trees is generally lacking, however. Observations in pine plantations in the Lake States furnishing such information are presented in this paper.

AT ONE time porcupines were protected as an emergency food source for men lost in the wilderness. Later, as the possibilities of becoming lost in the wild declined, it was realized that porcupines could cause much damage to forest trees. As a result, restrictions against killing porcupines were lifted.

When a porcupine gets hungry, he usually climbs a tree and begins to feed on the tender bark of the upper stem. Often he continues to gnaw off the bark until he has girdled the stem. Then the part above the girdle dies; the tree develops poor form; the quality of its products is reduced; and other types of injury may develop.

Where porcupines are numerous, they may do serious damage. Where they are few, the damage usually is negligible. On the credit side, porcupines are a tourist attraction, and their quills are used in considerable quantities on some of the Indian beadwork.

That porcupines like some kinds of trees better than others is known in a general way. However, there is still much to be learned about the food habits of porcupines. For this reason, observations made in pine plantations in the Lake States should be of interest.

Damage in Northeastern Minnesota

Detailed observations were made in an 18-year-old (from seed) plantation of about 4½ acres established on the Superior National Forest in northeastern Minnesota in 1931, to test 37 seed sources of red (Norway) pine and 20 sources of Scotch pine. During the summer of 1946 each tree was measured and examined. The injuries caused by porcupines were noted along with those from several other agencies. Only 2 out of 1,739 red pine (0.1 percent) had been gnawed by porcupines, but 177 out of 1,527 Scotch pine (11.6 percent) had been so attacked.

How severe is the damage to the Scotch pine? About one out of every eight Scotch pine had been gnawed by porcupines. Of these trees, 6 percent were dead or dying, 45 percent were seriously damaged, and the remaining 49 percent were only lightly injured. Perhaps that isn't serious, but unless control measures are taken, the damage doubtless will increase. Lightly injured trees will become badly damaged or die, and additional trees will be injured.

What size trees did the porcupines feed on? No size seemed to be immune. They fed on trees from 0.3 to 6.7 inches in diameter and from 4 to 20 feet tall—about the range of sizes in the stand. However, they showed a definite preference for the larger trees (Fig. 1). The trees attacked averaged 3.9 inches in diameter at breast height and 14.9 feet in total height, as compared to 3.0 inches in diameter and 13.0 feet in height for all the trees in the stand.

From these observations it appears that porcupines prefer trees at least 3 inches d.b.h. or 14 feet in height, although they do work on smaller trees. Presumably the smaller trees provide less bark for food, less security while feeding, and are more difficult to climb. Porcupines do gnaw on trees without first climbing them, but that is the exception.

Scotch pines of northern European origin were much less injured than those of the central European type (Table 1). However, this seems more a matter of tree size than of seed origin. One lot from Asia was relatively heavily damaged for its size. The sources of central European type averaged larger than those from northern Europe or Asia. The sources most damaged were those which ranked highest in diameter and height development.

Damage in Other Lake States Localities

That these results are not mere chance is shown by corroborative evidence from a Scotch pine plantation on the Huron National Forest in lower Michigan, a jack pine plantation on the Nicolet National Forest in Wisconsin, and general observations throughout the region.

A Scotch pine plantation of about 3 acres was planted on the Huron National Forest in the fall of 1931. It involved the same seed sources as were used in northeastern Minnesota. It was examined at an age of 17 years from seed

TABLE 1.—PORCUPINE INJURY BY SEED SOURCE, 18-YEAR-OLD (FROM SEED) SCOTCH PINE IN NORTHEASTERN MINNESOTA

Seed collection	Region of origin	Average height	Average d.b.h.	Trees injured by porcupines
		Feet	*Inches*	*Percent*
97	Central Europe	15.0	3.90	32
99	" "	15.0	3.86	19
57	" "	15.0	3.64	23
58	" "	14.7	3.62	30
96	" "	14.5	3.55	16
59	" "	14.7	3.51	23
127	Northern Europe	13.2	3.40	4
128	Central Europe	13.4	3.22	6
68B	" "	13.4	3.10	19
69B	" "	13.0	3.00	2
102	Northern Europe	12.0	2.84	2
94	Central Europe	13.4	2.83	3
69A	" "	12.5	2.83	3
91	Asia	11.6	2.76	9
130	Northern Europe	11.0	2.44	0
98	Central Europe	11.9	2.41	3
101	Northern Europe	11.3	2.37	0
95	Central Europe	11.5	2.30	2
100	" "	11.7	2.19	2
113	Northern Europe	10.1	2.04	0

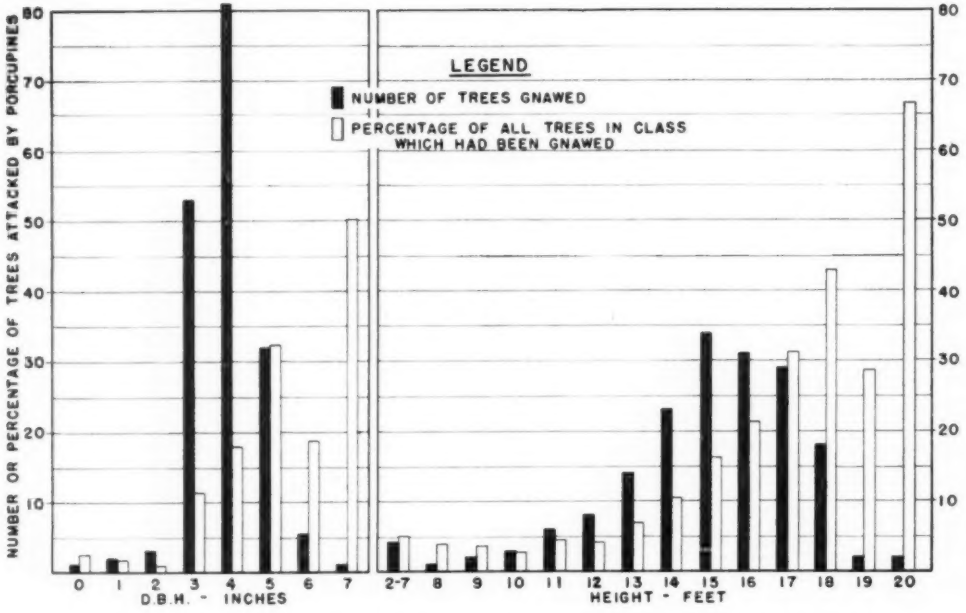
NUMBER OR PERCENTAGE OF TREES ATTACKED BY PORCUPINES
LEGEND
NUMBER OF TREES GNAWED
PERCENTAGE OF ALL TREES IN CLASS WHICH HAD BEEN GNAWED
D.B.H. - INCHES
HEIGHT - FEET
0 1 2 3 4 5 6 7
2-7 8 9 10 11 12 13 14 15 16 17 18 19 20
10 20 30 40 50 60 70 80

FIG. 1.—Sizes of trees attacked by porcupines in 18-year-old Scotch pine plantation in Northeastern Minnesota.

A. According to diameter. B. According to height.

—one year younger than the Minnesota plantation. Porcupine damage was much less severe than in Minnesota (0.75 percent of the trees injured as compared to 11.6 percent), but the preference for larger trees was the same. The trees attacked by porcupines averaged 3.3 inches in d.b.h. and 15.3 feet tall. The average size for all trees in the plantation was 2.3 inches in diameter and 11.7 feet in height. The seed source sustaining the heaviest damage was the same in both Minnesota and Michigan plantations. In both localities this seed source had larger trees than any other source. Four out of five sources injured were of central European origin. The porcupines apparently selected these sources chiefly because they had large trees.

In a 14-year-old (from seed) jack pine plantation on the Oconto district of the Nicolet National Forest, 747 out of 6,592 living trees (11.3 percent) had been damaged by porcupines.[1] An additional 42 trees were killed. The trees in this plantation were similar in size to those in the Scotch pine plantations described. Although detailed observations are not available, the same tendency of the porcupines to select the larger trees was evident. Other pines and spruce planted in mixture with the jack pine were largely ignored by the porcupines.

Other Evidence

Interesting confirmation of these observations upon porcupine preferences in feeding comes from a study made in a different region and with different species. An intensive investigation of the porcupine was made on the Mesa Verde National Park in southwestern Colorado.[2] Damage was very heavy; 84 percent of the pinyons (the most common pine) and 86 percent of the ponderosa pine had been injured. It was observed that while trees of all sizes from seedlings to mature veterans were attacked, the porcupines preferred trees over 4 inches d.b.h., especially the better dominants and codominants.

Practical Significance

Scotch pine is not likely to be planted very widely for wood production in the Lake States, so results with that species may not seem important. However, indications are that the extent of damage and the size of trees preferred by porcupines probably would be similar in plantations of those native species which porcupines like. Plantations of jack pine, white pine, or tamarack probably would need protection from porcupines—where they are common—beginning about the time the trees reach 3 inches in diameter. With that knowledge, needs and plans for control can be determined ahead of the actual need.

[1]Observations made by J. H. Stoeckeler of the Lake States Forest Experiment Station.

[2]Progress report, porcupine investigations on Mesa Verde National Park, winter 1946-47. By D. A. Spencer (U. S. Fish and Wildlife Service) and Jack Wade and Monte Fitch (National Park Service), 36 pp., typewritten.

Producing Elm Seeds on Cut Branches[1]

Jonathan W. Wright
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Indoor pollination is now used regularly in breeding poplars, and it can be used in breeding other genera. Indoor pollination not only lengthens the breeding season by 2 to 8 weeks; it also enables the tree breeder to pollinate early-blooming trees by late-blooming trees, to work trees from several localities at the same time, to work trees in exposed locations, and to guard against complete loss from unfavorable weather.

THE production of seed on cut branches kept indoors was first reported by Wettstein-Westersheim[2] for willow. Many others have since followed his technique. Vegis[3] and Krijthe[4] had moderate success in maturing elm fruits on cut branches. Vegis, following Wettstein-Westersheim's method, kept the cut branches in Knop's solution. Krijthe kept branches of *Ulmus pumila*, *U. japonica*, and *U. hollandica belgica* in moist peat moss; he obtained 269 seeds from 15 branches (of 108 branches used).

To extend these findings about elm to the American species and to determine the best conditions for maturing fruit, studies were made of cut branches of American elm (*U. americana*) and slippery elm (*U. fulva*). Some tests were also made with Siberian elm (*U. pumila*), Wyche elm (*U. glabra*), Camperdown elm (*U. glabra* f. *camperdownii*), and Wheatley elm (*U. carpinifolia* f. *sarniensis*).

Dormant flowering branches, varying in length from 4 inches to 5 feet and in diameter from $\frac{1}{8}$ to 1 inch, were collected at various times during the winters of 1942-43, 1943-44, and 1944-45 in the vicinity of West Lafayette, Ind., and from the campus of Purdue University. They were kept moist until they could be taken into a greenhouse, not more than 4 hours after cutting. In the greenhouse, they were set 6 inches deep in various moisture-retaining media (sand-soil, sand-peat, and water). No attempt was made to root the branches, and none rooted. However, some callused. The flowers were pollinated by shaking flowering branches (usually from a different tree of the same species) in their vicinity.

These tests were made under several temperature conditions: in greenhouses having temperature ranges of 52° to 65° F. and 65° to 70°F.; in a high-humidity orchid house kept at 70° F., and in a laboratory kept about 72° F. After early April, the daytime temperatures frequently were higher in all these places.

American and Slippery Elms

Effects of season of cutting.—At the time the first cuttings were made in November the flower buds of both American elm and slippery elm were already well organized. Their scales were tightly closed, and they contained unopened flowers that were complete with calyx, pistil, and stamens. In both species the branches brought in at that time required about 25 days to bloom; the few flowers that opened dropped a few days later.

During December and January there was a marked reduction in the time necessary to force the cut branches into flower (Fig. 1), although there were no obvious changes in the size or organization of the flower buds during this period. Beginning in early January the flowers remained on the branches long enough after flowering to produce full-sized parthenocarpic fruit.

TABLE 1.—FRUITING DATA FOR CUT ELM BRANCHES KEPT IN GREENHOUSES (52°-65° F.), WINTER 1943-1944

Date[1] brought inside	Branches brought inside	Branches that matured seed		Mature fruits with good seeds
		SLIPPERY ELM		
	Number	*Number*	*Percent*	*Number*
Feb. 19	84	5	6	26
Feb. 24	119	44	37	110
March 2 ...	59	10	17	63
March 20 ..	170	78	46	93
April 9	153	86	56	426
		AMERICAN ELM		
Feb. 24	51	2	4	2
March 2 ...	98	1	1	4
March 29 ..	25	19	76	890

[1]No seeds were matured on branches collected earlier than Feb. 19.

[1]This study was made while the author was instructor in forestry at Purdue University.

[2]Wettstein-Westersheim, W. von. Zur Technik der kunstlichen Kreuzung bei Weiden (*Salix*). Der Zuchter 1:125-126. 1929.

[3]Zamelis, A. Bedeutung der Genetik in der Systematik und Geographie der Pflanzen. Genetica 13: 151-182. 1931.

[4]Krijthe, N. Verslag over de werkzaamheden voor het iepenziektecomite, verricht ann het laboratorium voor erfelijkheidsleer in 1938. Tijdschr. Plantenziekten 45 (2): 63-70. 1939.

By mid-February the buds on trees outside were starting to expand slightly. In the greenhouse, there was a still further reduction in time necessary for flowering. The branches brought in after mid-February matured fruit. With the advance of the season until normal anthesis (the time when regular flowering occurs) outside there was a still further decrease in the flowering time and a decrease in the period from anthesis until the fruit matured (Fig. 1). There was a simultaneous increase in the percentage of branches maturing fruit and in the number of good fruits matured per branch (Table 1). With the slippery elm, reasonable success was obtained from branches brought in as early as mid-February, but with the American elm no fruits were matured from material collected more than 2 weeks before normal anthesis outside.

These changes in flower performance with time are probably related to internal changes in the flower. Shattuck[5] found that in American elm the microspore mother cells undergo meiosis, the megaspore mother cells begin to enlarge, and the second integument starts to form about 40 days before anthesis. The be-

[5]Shattuck, G. H. A morphological study of *Ulmus americana*. Bot. Gaz. 40:209-233. 1905.

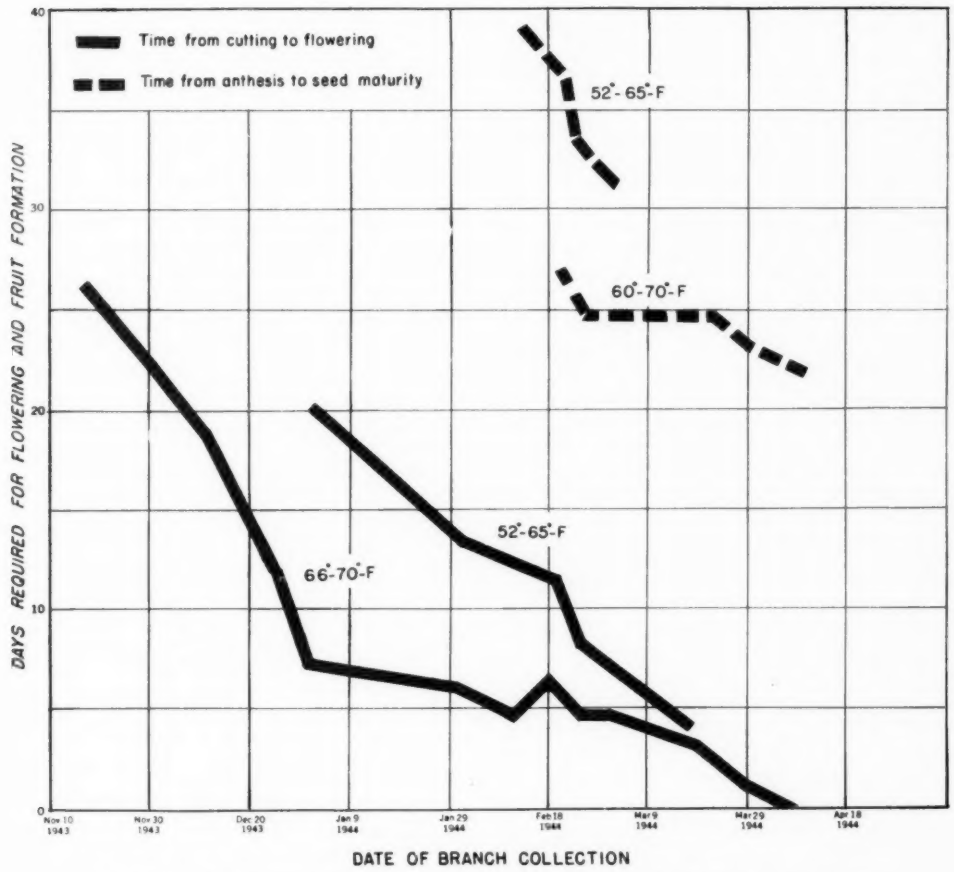

FIG. 1.—Effect of season of cutting on time needed to force flowers and fruit on American and slippery elms. Data for the two species are grouped, because differences were slight.

ginning of successful fruit set in March corresponds approximately to the period of wall formation between the tube and generative nuclei and formation of the eight-nucleate embryo sac about 10 days before anthesis.

Effect of branch size.—With slippery elm the best results were obtained from branches 1 to 3 feet long pruned to a top diameter of ¼ inch. Such material usually has a basal diameter of ⅜ to ¾ inch and bears only one to two short flower-bearing laterals. Single branches often bore up to 15 good seeds. Optimum branch size was similar for the American elm, but pruning of the tip and laterals was not found necessary. Cuttings composed entirely of first-year wood (or with a basal diameter of less than ¼ inch) flowered readily, but rarely matured fruit. Very large branches (up to 5 feet long and 1 inch in diameter) gave satisfactory results, but were difficult to obtain and handle.

Effects of temperature.—Early in the season there was a marked difference in the forcing and fruiting times of the branches kept in the various greenhouses (Figure 1). Material kept at 52° to 65° F. required about twice as long to come into bloom as that kept at 65° to 70° F., which in turn required about one and one-half times as long as that kept at 70° F. in the orchid house or laboratory. The time necessary for fruit production was about 30 percent greater for the material kept in the cool greenhouse than for the material kept in the 65° to 70° F. greenhouse. Late in the season the differences in flowering and fruiting times between the greenhouses became much less pronounced. This may have been due in part to a change in the temperature requirements of the bud and in part to the fact that during March and April high outside temperatures made it impossible to keep the low-temperature greenhouses as cool as previously.

With respect to the percentage of branches that matured fruit, the best results were obtained in the cool greenhouse for material brought in during February, and in the 65° to 70° F. greenhouse for material brought in later. No fruits were matured on material kept in the orchid house or in the laboratory.

The processes of fruit enlargement and seed enlargement appear to have different temperature coefficients. In the orchid house the fruit often reached full size and dropped before any noticeable development of the seed began.

Effects of other factors.—The relative humidity was maintained above 40 percent in the greenhouses. The tops of the branches were given no protection against drying out. Nevertheless there was no desiccation such as Krijthe[4] reported in his greenhouse experiments. However, branches kept in sand-soil or water in the laboratory consistently failed to retain their flowers after anthesis, and did show signs of desiccation.

Most of the tests were conducted with branches kept in sand-soil moistened from above with tap water. However, the results were similar when sand-peat or water was used.

With both the American and slippery elms there was considerable variation among trees in the ability to respond to forcing and to develop good fruit on cut branches. Whether this is due to genetic variation within species or to preconditioning of the entire tree is unknown. Throughout a single season the results from a single tree were fairly consistent, but no tree gave consistently good or consistently poor results during all 3 years of the tests.

Other Species

Branches of Siberian elm brought inside during November and December required but half the forcing time needed by the American and slippery elms brought in at the same time. Like slippery elm, they consistently failed to retain their flowers more than a few days after opening. The buds of branches cut later in the season were found to have been entirely winter-killed, and failed to open.

Branches of the Wyche elm, the Camperdown elm, and the Wheatley elm behaved similarly to the slippery elm. When brought in during the month before normal anthesis they flowered normally and produced good crops of parthenocarpic fruit. The Wyche elm and the Camperdown elm flowers were self-pollinated or pollinated with pollen of the American and slippery elms. Only a single specimen of Wyche elm was available on the Purdue campus. Several grafted Camperdown elm trees were available, probably all of the same clone. Hence the lack of viable seed set in these varieties may possibly be due to self-incompatability. Several trees of the Wheatley elm were available; these may have belonged to the same clone. The trees of these species from which branches were taken produced large crops of purely parthenocarpic fruit outside during the years of the tests.

Development of Flowers and Fruit

The most striking feature in the development of elm fruits on cut branches is the rapidity with which all processes take place. With collections of American elm or slippery elm made during late March, mature seeds were obtained 21 to 27 days after the start of anthesis; the corresponding period outside was 35 to 50 days.

The period of anthesis is especially rapid in the greenhouse. The interval between the start of filament elongation and anther dehiscence was 2 to 3 hours for a single flower and from several hours to a day for all the flowers on a branch. In contrast, the lengths of the periods of anthesis for outside trees of slippery elm and American elm were 7 days and 18 days respectively in 1944 and 2 days and 2 days in 1945. Because of the rapidity of flower opening, speedy and frequent re-emasculation are necessary where emasculation is attempted.

In 1944 a comparative study was made of the growth of seeds and fruits (Fig. 2). Outdoors, seeds and ovaries enlarged little for 12 days, then grew at a nearly constant rate until a week before maturity. Indoors, the seeds and fruits started to enlarge soon after pollination, and reached their full size in about 12 days. The average mature size of the seeds and fruits

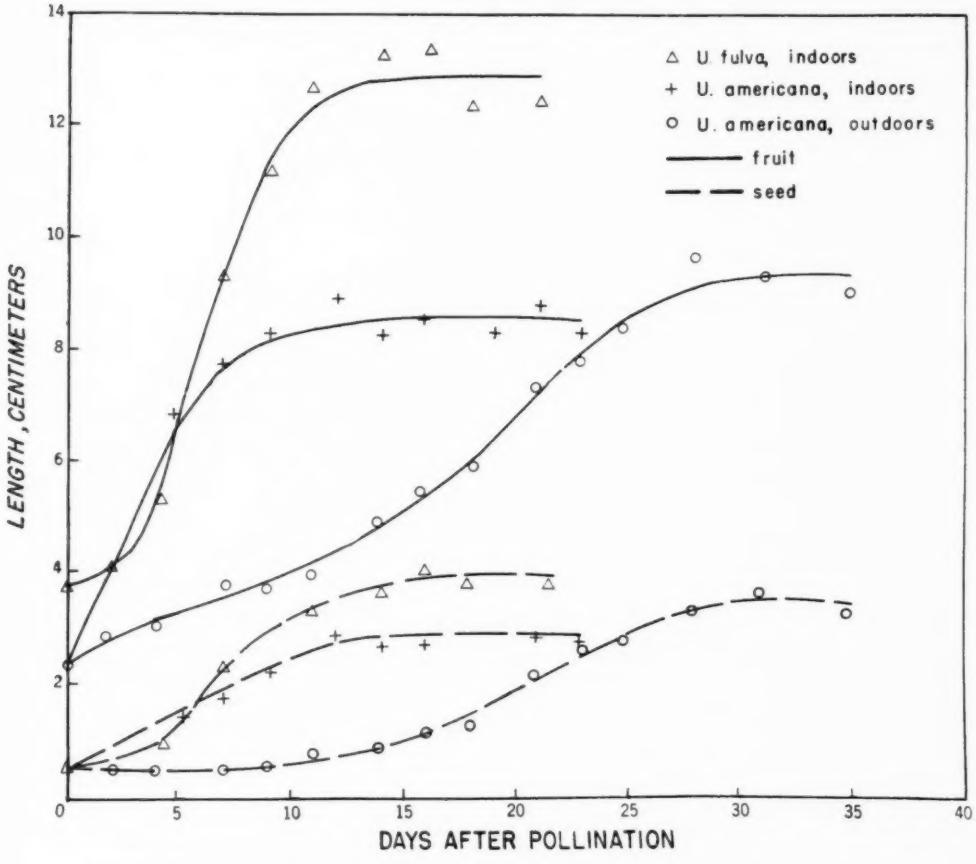

FIG. 2.—Comparison of growth of American and slippery elm fruit and seed indoors and outdoors. The indoor material was kept in the cool (52°-65° F.) greenhouse.

grown indoors was about 10 percent less than that of material developed outdoors. However, because of the earlier maturity and germination dates for the "indoor" seeds, it was possible to obtain larger first-year seedlings from them than from comparable "outdoor" seeds.

The Relative Merits of Indoor and Outdoor Pollinations

In both 1943 and 1944 late spring frosts reduced the seed crop on wild elms in the vicinity of Lafayette, Ind., to almost nothing. In contrast, from 20 to 60 percent of the (optimum type) branches brought inside produced crops of up to 15 seeds per branch for the slippery elm and of up to 100 seeds per branch for the American elm. In 1945 the situation was reversed, for there was a bumper crop outdoors and little seed set indoors.

By using indoor pollinations, the breeder can extend his breeding season by 2 to 8 weeks, can pollinate early-blooming trees by late-blooming trees, can work trees from several localities at the same time, can work trees in exposed locations, and can guard against complete loss by unfavorable weather. On the other hand, the method has some disadvantages: lower seed yields per branch in good seed years, the need for greenhouse space, and the time involved in collection and preparation of the cuttings.

The method appears to be a useful supplement to conventional pollination procedures, but will not replace them entirely.

Abstract of Master's Thesis

Aerial Patrol by State Agencies in Connection With Detection of Forest Fires.
By Richard Marion Tannehill, Louisiana State University. 1948.

THE problem as handled in this thesis was to find out what had been done in the past, what is being done at the present, and the future plans of the state forestry agencies of each state concerning detection of forest fires by aerial patrol. The material was procured by questionnaire from the state agencies concerned and then compiled by United States Forest Service regions. The reason for this grouping is that the regions are well defined and recognized and are similar in topography. The results were very promising in that all state agencies agreed that the aeroplane has its place in a well organized detection system. However, the methods of using the plane, the type plane used and the equipment in the plane varied considerably as to localities and within localities.

Notes

Scientists and Reserve Officers

The Department of the Army has established a program of particular interest to foresters and other scientists who hold Reserve Commissions in the Army, and who are professionally engaged in teaching or research and development.

The objectives of the program are to: (1) maintain the useful affiliation of foresters and other scientists with the Organized Reserve Corps, (2) provide peacetime Reserve assignments for these officers, enabling optimum utilization of their education, experience, and skills, (3) furnish mobilization assignments which will fully utilize their talents, and (4) adequately prepare these officers for mobilization.

The technical Services of the Department of the Army submit to these Research and Development Reserve Groups research problems and projects which pose an intellectual challenge to members of the group. Thus, the problem provides members of each group a type of training which is in keeping with their scientific and technical interests and competence, rather than a traditional kind of training session in which scientists have little or no interest.

The program is now being implemented only in those areas where there is a definite local interest. To date, eighteen Research and Development Reserve groups have been organized. Twelve additional groups are in process of organization. Others are in the initial stages of formation. Several of these groups have been formed in communities in which large universities, industrial research laboratories, or private research foundations are located. Typical localities are Chicago, Illinois; Wilmington, Delaware; Newark, New Jersey; Houston, Texas; Washington, D.C.; Manhattan and Lawrence, Kansas; Champaign-Urbana, Illinois; Pittsburg, Pennsylvania; Denver, Colorado; and Detroit, Michigan.

Provision is made to submit research projects of interest to all categories of scientists—chemists, physicists, engineers, geologists, geographers, psychologists(mathematicians, and all of the biological scientists which will include forestry.

Reserve officers who are currently engaged in civilian research, college or university teaching, or industrial research or development, or who in the past have had specific research experience are eligible to make application for assignment to an Organized Reserve Research and Development Group. A group may be organized in any locality where there are twenty (20) or more qualified officer scientists who desire to participate in the program. A subgroup may be organized with ten (10) qualified members.

The program is under the general direction of the Research and Development Group, Logistics Division, General Staff, United States Army. The entire program is outlined in Department of the Army Circular Number 127, dated 5 May 1948.

Inquiry about organization of an Organized Reserve Research and Development Group or about assignment to a group already organized should be made of the Unit Instructor, ORC, or of the Senior Army Instructor, ORC, in the locality in which the officer resides. In localities in which a group has already been organized, the Commanding Officer of the group will consider applications for assignment of additional officers.

A Farm Forestery Program for Rural Schools

The farm woodlot is rapidly becoming more important as a source of wood for local wood-using industries in Northeastern Minnesota. This industry has over the past 30 years changed from that of lumber production to varied production of pulp and paper, matches, poles, piling, mine timber, ties, and lumber cut from small-sized trees. This change has increased the demand for fast growing, short-lived trees that were once considered forest weeds. The utilization of small-sized wood makes it possible for a farmer to grow a crop of timber within his own lifetime. Industry has recognized the importance of the woodlot, but not the farmer.

Northeastern Minnesota is not a good farming area, consequently, many of the farm inhabitants spend part of their time working in the woods for others, or in nearby mines. Supplementary income is a necessary part of the farmers' economy. Farmers own a large area of commercial forest land but it contributes little to the wood supply because the woodlots are run down. The stands are poor due to poor cutting practices,

grazing, fires, and lack of care. The agencies that work closely with the farmers have not emphasized enough the part a well-cared-for woodlot could play in the farm economy. Lack of farm foresters and funds to carry out the educational and practical work delays improvement.

Problems that were mentioned above can be solved in part by better education of the future farmers. Many rural high schools are doing just that.

A farm forestry program covering 14 counties has been set up in Northeastern Minnesota under the auspices of the Iron Range Resources and Rehabilitation Commission. One forester is working full time in the largest county, which has 6 high schools attended entirely by rural students.

The forester prepares all lesson material and directs allied activities. Leading foresters located in the area assist. Travel expenses are taken care of by local paper companies who are vitally interested in the welfare of the surrounding communities and farming areas.

The subject matter covered includes history of our woodlands; farm woodlands in farm management; forestry and farm woodland; the compass; mapping; the biltmore stick; the hypsometer; the woodlot forest; pruning; windbreak planting; tree identification; forest fires and their prevention; measuring and evaluating farm timber; log scaling; timber stand improvement; and suggested cutting guide for aspen.

The schedule is drawn up with each instructor in the various schools visited. For the past year a session of one day per month for each school was arranged and followed. For this year a 3-day stay at each school has been arranged giving the forester a better chance to cover his subject and more time with each class on field trips and demonstrations.

During the past year the program included the veterans institution on farm training as well as the various conservation classes in addition to the vocational agriculture classes. A total of 502 rural people received some farm forestry training. The number of students reached this year should be higher because of increased enrollment.

To place greater emphasis on the program, a woodlot management contest is sponsored by the local wood-using industries. The work done by entrants was highly commendable. It also brought to light the fact that a well-cared-for woodlot could contribute substantially towards the farm economy and that much of the work that is done during the slack periods of the year. These projects help the forester to interest people and classes during field trips. Through their use the program of woodlot care and management can be driven home to those who fail to see the real worth of a woodlot on the farm.

The part the woodlot of the future is going to play towards supplying the needs of the wood-using industries is going to depend upon how well informed our future farmers are in the care and management of the woodlot and how willing they will be to apply their knowledge.

JOSEPH P. OGRINC,
Office of Iron Range Resources and Rehabilitation.

White Speck Lumber

Some recent observations on the presence of white speck (more accurately and preferably termed white pocket rot) in lumber have focussed attention on its use in building construction. The topic is of increased interest because of the present commercial harvesting of timber stands in which trees contain considerable amounts of white speck. Formerly trees of this type were often left to waste in the woods, or were not accessible to the logging industry. In the interest of conservation it is desirable to use lumber containing white speck where use requirements permit.

There are many satisfactory uses for lumber containing white speck. High strength is not generally required for sheathing, core stock, subfloors and roof boards, and white speck lumber may be used for these purposes. When used for joists, studs, and framing in house construction, care should be taken to select a grade that will provide sufficient strength for the purpose intended.

Pending further examination of the subject, white speck lumber should not be put to structural uses that have a high strength requirement. As currently graded, white speck lumber is not admitted in the grades of lumber designed to meet such high strength requirements.

It is important that users understand clearly the nature of white speck and the limitations imposed on the use of lumber containing it. White speck is caused by the fungus *Fomes pini* which destroys wood cell structure in progres-

sive degrees. In its final stages the rot riddles the heartwood with spindle-shaped pockets which are lined with strands of nearly pure cellulose. After the lumber containing *Fomes pini* has become continuously dry (less than 20 percent moisture content, which is normal for housing lumber not exposed to the weather) the fungus will not progress further. If it becomes wet again, white speck lumber, like lumber free from this defect, is subject to decay caused by other fungi.

Knots and other growth characteristics reduce strength according to their magnitude. White speck in the advanced stages of decay likewise materially reduces the strength of wood in bending, compression, toughness, and stiffness. The reduction in strength is gradual, beginning just before the advanced stage is reached and increasing as decay progresses. U. S. Dept. Agr. Bull. 779 shows that, in the advanced stages of decay, bending strength is reduced as much as 50 percent, compared to clear lumber free of all defects. Likewise, compared to clear lumber, compression is reduced as much as 30 percent; impact as much as 40 percent; and total work in bending as much as 80 percent. Since lumber containing white speck provides lower strength values, commercial standards classify lumber containing white speck—as well as that containing large knots, knot holes, shake, split, et cetera—into the lower grades which are not expected to furnish high working strength.

When high nail-holding power is a definite requirement, allowance should be made for reduced nail-holding power. More nails or larger nails or both would be required to obtain the same holding power.

For practical purposes the effect of *Fomes pini* in reducing the strength of lumber does not progress beyond the time at which the lumber is manufactured. Thus it is possible properly to classify and grade white speck lumber to meet specific use requirements at the time of manufacture.

FOREST PRODUCT LABORATORY.

Douglas-Fir Tree Makes Best Growth During Mature Stage

In 1942 several hundred felled Douglas-fir trees on a timber sale area on the Mescalero Indian Reservation in southern New Mexico were measured for the purpose of constructing a board-foot volume table. Among the trees measured was one that was 500 years old. The tree had a diameter of 50.6 inches d.b.h. and a total height of 130 feet. The merchantable height was 116.5 feet and the gross board-foot volume 3,987 feet (Scribner Decimal C scale).

The diameter growth made by this tree during successive intervals was determined by making ring counts on the stump. Table 1 shows the growth made in both diameter and basal area during successive intervals of 20 years each. It will be noted that the best diameter growth was made after the tree had reached an age of 200 years and that the greatest growth (4.0 inches in 20 years) occurred after the tree had attained an age of 240 years. Although diameter growth subsequently fell off, growth in basal area continued to be put on at a high rate, the maximum occurring at age 340 with only slightly less growth during the 20-year period beginning at age 380. At 400 years growth in basal area began to fall off but during all the succeeding 20-year periods continued to amount to more than that occurring in any period preceding age 180.

The good growth made by this tree is undoubtedly a reflection of an exceptionally good site. It stood in a shallow swale, thus not only having a deep soil but also receiving additional

TABLE 1. INCREASE IN DIAMETER AND BASAL AREA OF A 500-YEAR-OLD DOUGLAS-FIR TREE DURING 24 CONSECUTIVE 20-YEAR PERIODS, BASED ON ANNUAL RING COUNTS MADE ON STUMP OF THE FELLED TREE

Age	Diameter I. B.[1]	20-year increase Diameter	Basal area
Years	*Inches*	*Inches*	*Sq. feet*
20	0.4	2.0	0.021
40	2.4	1.3	.043
60	3.7	1.3	.062
80	5.0	1.8	.116
100	6.8	2.0	.170
120	8.8	1.3	.134
140	10.1	2.7	.337
160	12.8	1.8	.269
180	14.6	3.2	.566
200	17.8	3.9	.840
220	21.7	3.5	.895
240	25.2	4.0	1.187
260	29.2	2.4	.796
280	31.6	3.2	1.159
300	34.8	2.7	1.062
320	37.5	2.8	1.191
340	40.3	2.8	1.274
360	43.1	1.8	.864
380	44.9	2.5	1.259
400	47.4	1.6	.841
420	49.0	1.9	1.035
440	50.9	1.1	.617
460	52.0	0.9	.515
480	52.9	1.0	.583

[1]Diameter inside of bark at beginning of each period.

moisture from surface run-off. The fact that the tree had made such good growth over so many years indicates that it did not meet with serious competition from other trees. The fluctuations in amounts of periodic growth are probably due to differences in climatic conditions, chiefly precipitation.

While it is realized that the growth made by this particular tree is unusual, it nevertheless verifies what has been found to be true of mature Douglas-fir trees in cut-over stands; namely, that when such trees are thrifty and have been given ample growing space as a result of cutting neighboring trees, their diameter growth becomes greatly accelerated and continues at a high rate over a long period of years. In marking virgin Douglas-fir stands for cutting one should not hesitate to reserve thrifty mature trees for further growth provided, of course, that reserving them will not interfere with the growth of thrifty younger trees nearby.

HERMANN KRAUCH,
Southwestern Forest & Range Exp. Station.

Abstract of Master's Thesis

A History of the Ringnecked Pheasant in Michigan. By John E. Wilson, University of Michigan. 1948.

The constant demand by sportsmen for an increase in pheasant numbers since its introduction into Michigan reflects its popularity as a game bird. In terms of human pleasure, it is difficult to ascertain its value upon the Michigan scene. The pheasant has certainly added in terms of beauty and interest to the rural areas, and thousands of dollars are spent annually afield in quest of the "ring-neck." It is doubtful that any native species could have survived in huntable numbers in southern Michigan as it evolved into an agricultural region.

Under the present stabilized land use practices in the state, the pheasant should continue to supply a large share of the game bag. Peak populations brought about by a set of ideal environmental conditions may occasionally result in excessive numbers. Trends such as this, suggestive of cyclic phenomena, do not seem indicative of the normal population in the state. As land values in southern Michigan seemingly do not warrant management for pheasants alone, we must be satisfied with the greatest possible return under the best type of integral land use in this region.

Chronology

1893 Pheasants introduced into Michigan by Arthur Baumgartel of Holland, Michigan.
1895 First pheasants released in the state, 6 miles north of Holland, Michigan, by Arthur Baumgartel.
1913 First Michigan Hunting License Law, Public Act 108.
1917 Hunting License Act, dollar charge made for a license to hunt small game in the state.
1917 Establishment and purchase of the Mason State Game Farm 4 miles southeast of Mason, Michigan.
1917 Horton Trespass Act, law made it a misdemeanor to trespass on private land.
1917 Initial pheasant stockings made by the State Conservation Department.
1925 Ming General Game Bill, first open season on Michigan pheasants.
1929 Horton Shooting Preserve Act, right granted to raise birds on private lands for shooting in an extended season.
1928
1929 Manistee and Menominee Experiments, proved conclusively the inadvisability of stocking of pheasants in the northern counties in Michigan.
1929 Introduction of the Williamston Plan, co-operative hunting units open to public use under direction of the landowner.
1935 Repeal of the Shooting Preserve Act.
1944 Peak kill of pheasants reached in the state, 1,401,076 male birds estimated taken by Michigan hunters.
1945 Crash decline in the state pheasant population.
1948 Pheasant Restoration Program, state and landowners cooperate in a habitat improvement program.

We Present

Gilmour Byers MacDonald

A short time ago one of the Iowa State College forestry graduates was confiding in another that he always received a great emotional uplift and renewal of purpose toward his job after conferences with Prof. "Mac." The man in whom he was confiding immediately replied, "There is nothing so unusual about that. Everybody does."

Perhaps this explains in part Prof Mac's success in building up and maintaining a forestry school in the center of the Iowa corn fields from 1910 to the present date.

Gilmour Byers MacDonald began his life in a Presbyterian parsonage at Carleton, Nebraska, and continued to enjoy the healthful atmosphere of the parsonage with his six brothers during his boyhood days. He had completed a year of college work at the University of Nebraska and had worked for over a year on a California fruit ranch and in a large department store in Sacramento before he was aware of the existence of the forestry profession. In 1904 he was encouraged by Dr. G. E. Condra, of the University of Nebraska, to investigate this new field, forestry, which in Dr. Condra's opinion, had great possibilities for a young man. It may be that Dr. Condra was also anxious to see Gilmour on the University of Nebraska football squad since he had developed into a star performer at Lincoln High when Dr. Condra was coaching high school football.

Forestry appealed to Gilmour from the beginning. He graduated from the University of Nebraska in 1907 with a B.S. degree in forestry, and with honors in both football and track. His track specialty was the pole vault. He earned a Master of Forestry degree at Nebraska in 1914.

His first forestry employment was at Halsey Nebraska where he was introduced to forest nursery operations. Here he apparently set the pace for working hours which he has followed throughout his life. After using the daylight hours on the heavy work demanded in the nursery, it is said that he made excursions into the surrounding countryside by lantern light in search of botanical specimens.

Following graduation in 1907 he entered the U. S. Forest Service, where much of his time was devoted to reforestation activities. On the Medicine Bow National Forest in Wyoming, he supervised the collection of three thousand bushels of pine cones. During the winter of 1907-1908, while on detail in Washington, D. C., he prepared plans for planting and for the establishment of forest nurseries in the West. In 1908, he was given the assignment of starting the Pocatello Forest Nursery, and in 1910 he was in charge of the Boulder Forest Nursery in Montana.

In 1910 there was only one person teaching forestry subjects at Iowa State College. Quite by accident Gilmour met him one day at Lincoln, Nebraska and learned that he wanted to leave for a month during the winter to investigate other employment. Gilmour agreed to fill in as a substitute professor for one month. He and his bride of less than a month made an excellent impression on college authorities and were persuaded to return to Iowa State College to fill the vacancy the following fall.

GILMOUR BYERS MACDONALD

From that date until June of 1948, Prof Mac has been head of the Forestry School at Iowa State College. He has seen the school grow from a handful of students with himself as the only instructor to the present School of Forestry with a teaching staff of fifteen. Of most satisfaction to him are the hundreds of alumni who have found places of service in all fields of the forestry profession in almost every state of the union and many foreign countries.

Prof Mac has maintained an evangelistic fervor regarding the possibilities for forestry in Iowa. He has been State Forester for Iowa since 1935 and continues to hold that position. For many years he was secretary of the Iowa Conservation Association and one of its most active members in its purpose to crystallize conservation sentiment in the state. He planned and established the Iowa State Forest Nursery and during the days of the Civilian Conservation Corps he personally initiated the planning and was head of the Iowa C.C.C. program. He was a member of the Iowa State Planning board and a leading contributor to the plans dealing with forestry and soil conservation embodied in the Iowa twenty-year plan.

A devoted churchman, he holds several important offices and has been honored by a life position of elder of his church. He has been a city councilman of Ames for many years, a Rotarian and Boy Scout leader of note. He is the recipient of the honorary Boy Scout Beaver Award.

For several years, he was a member of the Executive council of the Society of American Foresters, which organization recently honored him by election to the grade of Fellow. In 1947, as fitting recognition for a life devoted to teaching and public service, and in appreciation of his esteemed personal qualities, inspired leadership and notable accomplishments, his Alma Mater, the University of Nebraska, conferred on him the degree of Doctor of Agriculture. Then in the spring of 1948, he was honored by being named by the Secretary of Agriculture to a newly created 3-man National Forests Board of Review.

Mr. Lyle Watts, Chief of the U. S. Forest Service, stated recently, . . . "Just as he influenced the lives of his students so has he influenced the life of his adopted State. It has been given to few foresters to lead his State in constructive progress for so long a period."

GEORGE B. HARTMAN,
J. A. LARSEN,
RUSSELL GETTY.

Points of View

"Neighbors Plan for Their Future"

The editorial in the November JOURNAL, while no doubt accurate in general, may be unduly pessimistic regarding the tropical forests.

Doubtless these are in part noncommercial for various reasons, such as rough and mountainous country, excessive cost of road-building in proportion to timber volume, and areas without sufficient species.

There are, however, considerable areas which are accessible and commercially valuable now. Yet they have all been written off togther, quite probably because there have been few foresters with logging knowledge who have so far reported on them. It would be very interesting to obtain the verdict of loggers with a good knowledge of Pacific Coast road-building and logging equipment and methods.

For example, in my judgment a considerable part of the forests of British Guiana, which is all in the tropics, is accessible to modern methods of logging. It is requisite to put together several methods, all of which have succeeded where they are suitable.

After seeing thousands of square miles of this forest from the air, travelling hundreds of miles by launch in the rivers, and traversing on the ground miles of forest which from the air appeared to be typical, there seemed no insuperable difficulties.

Government cruises over extensive areas indicate an average over all the area including waste land of over 6,000 f.b.m. per acre. This includes only species judged to be commercial, and from 16 inches and up in d.b.h.

Some species are very valuable, there are other excellent hardwoods, and another group suitable for more ordinary purposes. Some species are "sinkers," others readily floatable in the rivers.

The ground is flat or gently rolling. Maximum hauling distance is some 10 miles, the average around 5 miles, or less.

There is no fire risk; this is not a hurricane region. There is no need to log anything except large mature and over-matured trees, so that there is no problem of pre-logging or salvage logging such as harasses the Pacific Coast.

The conditions, therefore, suit selection logging, both from the standpoint of economical logging, and for the setting up of sustained-yield operations from the start. Foresters would have to study the succession after such logging, but it should be favorable. Mora reproduction is very abundant, and it is an important species.

Yarding would be by tractor-arch, in some areas by high-lead. Loading and dumping present no unusual problems.

The river system is the key to the whole operation. The rivers are deep, with well-defined banks, and run long distances with a steady current without obstructions such as rapids. On certain rivers there are rapids at intervals, others have none for many miles above tide-water. Rapids may be overcome by slides.

It would be necessary to bundle truck-loads of mixed species, so that the bundles will float. Bundling of small logs in truck-loads is standard practice on the Pacific Coast, in order to save loss in towing, and to cheapen the cost of towing. The timber can be concentrated to conversion plants on tide-water, plants adapted for permanent operation on a steady flow of raw material.

It is believed that the Orinoco and the Amazon have similar river systems; the timber stands would require study.

In such a climate, on favorable soils, the increment must be good, although too little is known about it.

The equipment for such logging must come from North America, also at first the technique of using it.

Once the local people are trained to operate modern equipment, there seems a likelihood that a large new supply of timber becomes available; and that the people in the accessible forest areas will prosper.

J. D. GILMOUR,
Toronto, Canada

"Social Approach to Sustained Yield Management"

I have been greatly stimulated by reading Earl Mason's "Social approach to sustained yield management," appearing in the December JOURNAL OF FORESTRY. It is quite evident that

Mason has given considerable thought and study to the problem of the owners of small woodland acreas and how they and their holdings are to be integrated in the over all picture of sound land use.

Mason's use of agricultural enterprise as a pattern for forestry is very much to the point. Here in the Northeast, at least, the basic concept in modern agriculture is the family size farm, Mr. Cline's statement to the contrary notwithstanding. It is true that the number of farms in the Northeast is decreasing while the size is increasing. This simply means that with modern farm machinery more acres can be farmed with the same man power. The family unit still remains.

Cline points out that small independent enterprises in other fields have had to give way to the more *efficient* (italics mine) larger organizations. Thank Heaven there are still other gods to worship besides efficiency. In our city of 25 000 there are three competing super markets and dozens of smaller grocery stores belonging to "chains" and yet one independent grocer in town is still doing business at the old stand, in fact has established a branch store in a new suburban development. The personalized touch of the grocer with his clientele is still appreciated.

Moving over into the forestry field there are records of small sawmills doing business at the same stand for five generations and the timber for processing still coming from the same general area subsidary to the mill.

After working for twenty-five years to get farmers to handle their woods with the same intelligence they do their crop land, I will have to admit plenty of evidence of poor cutting practices on the part of the small forest owner. No doubt my tools and techniques as an educator must bear part of the blame for this situation. But certainly large sawmills with band saws, steam niggers, jack ladders and hot ponds, representing the last word in efficiency will not reduce poor cutting practices on the lands of small-forest owners. I know of one such mill that after twenty years of operating is now reduced to sawing only two or three days a week, and the logs are being trucked in from distances of over a hundred miles.

The sawmill operated at Index, N. Y. by the Otsego Forest Products Cooperative is geared to the plan of processing timber grown by its members on a sustained yield basis. Its progress will be keenly watched by all foresters now that past financial mistakes have been forgiven and it is operating in the black. Even this efficient mill may be too large to fit the pattern of the small woodland holdings that are so typical of much of New York state. The log volume permits sawing only three days a week.

J. A. COPE,
Cornell University.

A Five-Year Professional Degree

The idea that training for the profession of forestry should be long enough to provide some liberal as well as technical education is at least as old in this country as the Yale School of Forestry. Discussion of proposals to lengthen existing four-year programs has been common. There seems to be general agreement among educators that at least five years are required to teach satisfactorily both the necessary technical and liberal courses, but so far very few forestry schools in the country have offered a five-year program. Some of these have been optional.

Each school fears to make a longer period of study compulsory lest it lose out in the competition for students. On the one hand, it fears that to award no more than a bachelor's degree after five years of study would turn students from forestry to other fields where the badge of "college graduate" may be achieved in four years; and on the other hand, the master's degree has traditionally been granted for a year or more of advanced study and does not seem to be a suitable award for the completion of five years of general and technical courses, all on the undergraduate level. So we continue to turn out foresters whose training is deficient by our own admission. This situation should be distressing to the whole profession. It is particularly distressing to those who attempt to persuade students to get a broader education. It is difficult for students to see the need for five years in college in the face of the present example of the forestry schools.

I propose the following, not necessarily as a new idea or as the best solution, but in the hope of keeping the matter before the Society to the end that it, by its requirements for membership and through its accrediting function, may set up standards which will permit all of the schools

to take together the step they apparently fear to take separately:

1. That forestry schools continue to grant the degree of Bachelor of Science, but that this not be considered a professional degree.

2. That they grant a professional degree after a five-year training period and that this not be a master's degree but something comparable in title to the degree of Civil Engineer.

3. That a master's degree be awarded, not merely for postgraduate work, but for at least one year of advanced study beyond the professional degree by students with superior undergraduate records.

GORDON M. DAY,
Rutgers University.

Reviews

Future Food and Agricultural Policy—A Program for the Next Ten Years. By John D. Black and Maxine E. Kiefer. 348 pp. McGraw-Hill Book Company, Inc., New York. 1948. $3.50.

At a particularly important time, the authors have undertaken to combine two important interests, the well-being of farming folk and the better nutrition of mankind, in proposing a balanced food and agricultural program for the United States. It includes production, distribution, and consumption phases and outlines methods and procedures in both the national and international spheres. Certain of the ideas and proposals are suggested as worthy of consideration for adaptation to the situations in other particular countries, so their proposal has international aspects.

Agriculture, as discussed, centers primarily in food and only that part of the problem is analyzed in any detail. Recognition is given, however, in the overall purview to the importance of wood for lumber and fuel.

Largely by ease illustrations and other factual presentations, the economic condition of agriculture and the food consumption and nutrition situation in the United States and the world at large are portrayed as they were in 1947 or can be expected to be in the succeeding ten years. In the treacherous situation in which the world finds itself, it cannot afford to take chances on running short of food. The authors consider it far better policy to let stock piles accumulate at the first chance and then take account of these in planning the production of ensuing years.

Again by illuminating references to case examples and other data the many parts composing the food and agriculture problem are analyzed and examined. The most basic of all problems is the ratio of the population to food-producing resources. It is demonstrated that increasing food production and increasing the power to buy food are not enough. Adjustment of population to resources is also necessary. Far more vital to the success of the FAO program (for attaining freedom from want of food, suitable and adequate for the health and strength of all peoples) than technological progress in agriculture or bringing new land into farms is what happens to birth rates and death rates in the next half century. In countries in which the population is moving toward its optimum, with the arts advancing faster than the population, a rising level of food consumption is possible, including a larger intake of protective foods.

The best course for a nation is to combine measures for raising urban and rural incomes and well-being. More progress will be made if each is supplemented by the other.

Food production and timber production are closely associated in a large fraction of the farms in the United States. Striking opportunities exist for increasing output.

The United States does not suffer from a lack of ability to produce enough food for adequate diets for its people. The major problem is keeping production and consumption of food in good balance at all times. This balancing needs to be done for each product. The second problem is developing methods of producing and distributing food that will lower the costs to consumers.

From a world standpoint, the foods needed for a continuous expanding population cannot be produced, except in the newer countries and in those with possibly expanding frontiers. Consequently, many countries must (1) expand their industries and exchange industrial products for food, (2) check the rate of growth of their population, or (3) subsist on inadequate diets.

The future food and agriculture programs of the world will evolve out of those the world now has. The actions of the farmers of the United States are more important than the public or governmental-action part of programs. In the field of processing and distribution, private action may effect food distribution and consumption tremendously.

The major problems facing the agriculture of the world are not problems of production alone, or of consumption alone, but of fitting one to the other.

The proposed balanced food and agriculture program for the United States consists of several principal features and a number of suggested possible variations and additions. The program is not tailored to fit any other country but might be adapted to a considerable number of them. It represents a goal toward which the authors believe that whatever measures are adopted in the next five or ten years could advantageously converge. It is intended as a beacon

which may help to guide even makeshift legislation in a common direction. The various parts are explained and illustrated with case examples.

A cardinal feature of the proposed program is that no individual producer quotas will be employed and that the old AAA system of quotas on historical bases will be abandoned. There is proposed instead a system of total annual quotas for each farm product, to be announced in advance of planting or breeding. The price or loan guarantee would cover only this volume of production. Carry-overs would preferably be figured in with the annual crops. This procedure will permit areas that produce most efficiently to expand and force the less efficient areas to shift to other lines of production. Growers would furnish bills of sale or comparable evidence to qualify for guaranteed prices.

The whole crop would be sold in regular open markets at whatever prices it will bring and the producer would be compensated for the difference between what he gets for his product, as evidenced by bills of sale, and the guaranteed price.

These supplementary payments may be paid in cash or in the form of various kinds of aids. They should generally be in the form of a grant-in-aid that matches, on a fifty-fifty or other basis, expenditures made by the farmer for the purposes defined or match labor performed by the farm working force. Among the purposes for which grants-in-aid might be made would be woodland improvements and marking trees to be cut and helping the farmer get bids on them.

No grants-in-aid would be made except on the basis of a firm plan which shows how the aid will be applied and how the aid will contribute to the objectives thereof or others of public policy. All aids to farm-woodland management will be based on plans that include the plans worked out with the help of the farm foresters jointly engaged in each state.

If the farmer is unable to make the cash outlays involved, he should be made loans to cover them at going rates of interest by local banks if possible or by local production credit associations or by the FHA. Aids that would be covered by grants in full or in large part would be fees for farm-woodland planning, etc. The aids might in normal times cover half or more of the cash outlays and labor for erosion control and farm-woodland improvement; in depression periods, still larger fractions.

Supplementary payments might be allowed to accumulate as credits to be claimed any time within, say, ten years. They would thus form a pool of reserve aid.

Another basic feature of the program would be supplementary food-distribution measures such as school feeding, supplementing diets of mothers, infants, and pre-school children, in-plant-feeding, and stamp programs.

Funds would be appropriated from the public treasury to meet the overall needs of the program. Each year they would be distributed in the way they would contribute most effectively to raising and stabilizing agricultural incomes and improving diets. About two billion dollars is suggested as the total amount for a normal year.

The authors assume that administration of the program would be headed up by the U. S. Department of Agriculture and believe that a national food and agriculture program board with state and county branches is essential for its successful conduct. They would not be operating agencies but would guide and direct the program.

Consideration is given as to how producers, consumers, processors and distributors, labor, other groups and government would participate in carrying out the program and to its relation to fisheries, fibers, and timber.

GEORGE R. PHILLIPS.

Boomzaden: handleiding inzake het oogsten, behandelen, bewaren en unitzaaien van boomzaden (Tree seed: a guide to its collection, treatment, storage and sowing.) By Nederlandsche Boschbouw Vereeniging. 171 pp. Ponsen and Looijen, Wageningen. 1946.

How would you like to have a compact volume summarizing, for the majority of useful trees and shrubs, information on seed collection, storage and treatment, germination percent, longevity, sowing in the nursery, direct seeding, and brief abstracts of pertinent literature? That is what the Netherlands counterpart of the Society of American Foresters has done in this volume. Any forester responsible for artificial regeneration of forest stands would welcome such a publication.

In 1943 the *Nederlandsche Boschbouw Vereeniging* appointed a special committee of forest-

ers and nurserymen to prepare a practical guide covering all phases of seed handling for the species grown in the Netherlands. The resulting publication, which has brought together information from a great many sources, is evidence that they did their work well.

Tree Seed is divided into three parts: (1) an introductory chapter, (2) a general discussion on collecting, treating, storing, and sowing of seed, and (3) detailed information on these subjects by genera and species. The second part covers such matters as importance of seed source, climatic races, selection of seed trees, cross pollination and hybridization, dioecism, time of collection, storage of fruits or seeds, treatment of various types of seed, germinative capacity and energy, dormancy and methods of overcoming it, and nursery practice.

Part three makes up the bulk of the publication. It contains detailed information for more than one hundred species arranged alphabetically by scientific generic names in two groups: conifers and broadleaves. Covered are 36 coniferous species of which 17 are North American, and 70 broadleaved trees and shrubs of which 17 also are native to North America. Several of the European species listed are also planted in the United States.

Perhaps the main criticism of this publication is its lack of illustrations. Aside from that fact it is an excellent work. There are a few typographical errors, which seems inevitable in a work of this size, but they are rare. Were *Tree Seed* written in English, it would be useful to many American foresters as it stands. That raises the question, "Why do we not have a similar volume for American conditions?" The answer is that we probably soon will. The Forest Service has been preparing a woody plant seed manual for several years. In conception and general arrangement it is very similar to this Dutch publication, and in species covered it is considerably larger. When it appears in print it should be as useful to American foresters as *Boomzaden* must be to the foresters of the Netherlands.

PAUL O. RUDOLF,
Lake States Forest Experiment Station.

Lore of the Lumber Camps. By Earl Clifton Beck. 348 pp. Illus. University of Michigan Press. Ann Arbor. 1948. $3.75.

This is a revised and enlarged edition of an earlier volume, *Songs of the Michigan Lumberjacks*, published in 1941. To compile it, the author has dug deep into hard-to-find source material. Although he is mainly concerned with the ballads and verses of the Michigan logging woods, his selections palpably are indigenous to no one state. The lumber industry was a migratory industry from its very beginning in America, and wherever the lumberjack went he carried his songs along, frequently changing place names and other localisms but generally retaining the essential story.

Mr. Beck has spent much time and effort in attempts to track down authentic variants of once well-known songs, and for those who delight in the folklore of the loggers and rivermen the author's diligence will be gratefully acknowledged. For example, the genesis of "The Wreck of the 'Julie Plante' " is most interesting, and the variations in several of its stanzas are pleasantly controversial. The truth is, of course, that different versions developed simply because the songs were customarily learned and repeated, not from the written words and music, but simply by word of mouth. What also makes the task of the compiler of folk ballads so difficult is the well-known fact that those who sang them were rude lusty men, separated for long periods from the alleged refining influences of feminine companionship, and stanzas were often introduced which are manifestly too gamy to be publishable.

The words of more than one hundred songs are given in this book, together with the music of a few. Included are two versions of the rollicking "Michigan-I-O"; that tale of hardships "A Shantyman's Life"; Paul Bunyan's "Round River Drive"; the popular "The Jam on Gerry's Rocks"; the stirring "Wild Mustard River"; and others too numerous to catalogue. To sum up, Mr. Beck has done a splendid job and the literature of our American forest industries is the richer for his good work.

Not so successful is that brief portion of the book devoted to tall tales. So much invention, not all of it inspired, has gone into the Paul Bunyan legend in latter years that it is almost impossible to separate the spurious from the authentic. As has happened so often and so tragically, the radio and the advertising fraternity have almost destroyed Paul's identity, and he is now used to sell everything from canned peas to secondhand cars. It's a shame, and the worst of it is that Pecos Bill and other heroes of

our native folklore have been similarly abused. Mr. Beck cannot, of course, do anything about this calamity, but it does somehow detract from his otherwise fascinating tall tales. As examples of the emasculating influence of commercial art on the wonderful Bunyan legend the book's four line drawings of episodes in Paul's career are cited. They are modernized examples of decorative art, and probably well drawn, but they are wholly out of keeping with the time honored conception of Paul's legendary character.

In compensation for the unfortunate drawings, the volume has a title page as handsome as any this reviewer has seen among the current crop of books. All in all, this is an attractive edition, beautifully bound and printed.

HENRY CLEPPER.

Propogation of Trees, Shrubs and Conifers. By Wilfred G. Sheat. 479 pp. Illus. Macmillan Company, New York and London, 1948. $7.50.

Compiled by an English horticulturist, the author makes his experiences available to other horticulturists, foresters, fruit growers and market gardeners, especially those who are interested in ornamental trees and shrubs.

The body of the book is divided into two main parts. The first, containing 400 pages, is devoted to the propagation of the Angiosperms. The second, with 41 pages, describes the same for the Gymnosperms. The methods are described in an alphabetical arrangement of the trees and shrubs by generic names. Every genus generally met with by the author has been included, and particular species and varieties within those genera have been described individually, where necessary, and collectively where one method is common to all. In most cases several methods of propagation are described in order of greater practicability. The methods are from seed, layering, grafting, or budding. The author further recommends the places where the operations are to be done, such as open ground, cold frame, greenhouse or sun frame, etc. In each description of a method much practical detail is included, which results in some repetition, but avoids the use of cross references.

The plant names are those that conform to the International Rules of Nomenclature and have for this purpose been guided by Rehder's *Manual of Cultivated Trees and Shrubs.*

Part 2 is followed by five pages of useful tables and other handy information, such as the weights of different kinds of soils, and the number of plants per acre spaced at different distances. The book is concluded by a complete botanical index of scientific names and a general index of common names.

The volume is well illustrated by five garden or plot layouts, four photographs, and the twenty-three full-page detail drawings by Owen Miller, showing for the most part different methods of grafting, budding, etc.

To the American forest tree nurseryman, who is accustomed to the growing of millions of small trees for reforestation from seed, this book is of little practical value, unless he is an amateur gardener on the side. The nurseryman who has problems in the growing of various hardwoods, or especially some of the game food plants, may find the treatise on special genera of interest. The forest tree breeder would profit by the fine illustrations.

This reviewer has one comment to make on statements referring to the storage of conifer seeds, such as, "seed should be gathered as soon as ripe, stored in sealed paper bags and hung in a cool, but airy dry room until the following spring," or "Pinus seed keeps well providing it is stored in a warm dry atmosphere." These statements reflect the nature of the author's experience. The suggested storage methods show that they are on a small scale and of short duration, in comparison with the better practice used in this country; that is, the practice of drying the seed, placing it in sealed containers and storing it at a constant temperature slightly above the freezing point.

To sum up, it is a good handbook for the horticultural gardener, whose work is the propagation of trees and shrubs on a small scale by the most feasible methods available to him.

E. J. ELIASON.

Foundations of Silviculture Upon an Ecological Basis. Second Edition Revised. James W. Toumey and Clarence F. Korstian. 468 pages. 1947. John Wiley and Sons, Inc., New York. $5.00.

When the first edition of *Foundations of Silviculture* appeared in 1928, it was the most complete English language textbook on the subject

indicated in the title. This edition, can well be accorded the same distinction.

In undertaking the latest revision, Dr. Korstian has modestly designated it the second edition, revised, instead of the third edition. This appears to be a proper decision, because in general coverage and presentation the changes are minor, in contrast to the extensive revisions that were made between the first and second editions.

The preface to the latest revision states that the purpose was to make corrections and bring up to date. In a nutshell, that is what has been done. The reviewers did not detect what corrections have been made, although undoubtedly there are some. The principal changes for the purpose of bringing up to date are:

1. Addition of approximately five pages of new material on weather with the captions "Weather; Sources of Air Masses, Characteristics of Air Masses, Highs and Lows, Air Masses of the United States, Fronts, Precipitation, and Storm Paths."

2. Some changes and additional material in the chapter "Soil Moisture and Its Influence on Forest Vegetation," including a new one-page section entitled "Absorption of Soil Water by Trees."

3. Further refinement of the discussion of tolerance. Shirley's recent writings on light and tolerance are given particular mention.

In various parts of the text, a number of more recent publications are cited. Altogether, about thirty new references have been added to the bibliography, to bring the total to 748. The references from the original edition include many from foreign sources, especially German articles, and many that are very old. Hence, considerable numbers are not accessible to most American foresters and students. The latest additions seem to represent a good cross section of recent contributions to forest ecology, plant physiology, tree classification, forest type classification, forest soils, and related subjects. Senior authorship to U.S.D.A. Technical Bulletin 767, *Natural Regeneration in the Western White Pine Type*, was incorrectly assigned to L. A. Isaac instead of I. T. Haig in the bibliography. However, the text reference to authorship is correct—Haig, Davis, and Weidman.

The extremely broad scope of *Foundations of Silviculture* may be a source of weakness in an up-to-date textbook. Today, there are increasingly greater numbers of specialized books that skillfully treat many of the components of foundations of silviculture. For example, the subject of forest soils recently has been made the subject of two college textbooks. Forestry graduates of the present pretty generally have taken full-fledged courses insoils. Hence, it is questioned if more than comparatively brief reference to forest soils is needed in a modern book on silvics. Similar comments can be made on some segments of the botanical material, including elementary botany, plant physiology, and elementary ecology. Some of the material in the chapter "Reproduction, Growth, and Yield of Stands," such as Sections 5-9, "Methods of Natural Reproduction from Seed," seems to reach over into applied silviculture, which is well supplied with textbooks and the subject usually is made a separate course of instruction. These comments are not intended to be regarded as advocacy of excessive specialization. Rather, they are pleas for (1) avoidance of duplication on course material and (2) brevity of treatment of what is at best a complex and difficult subject. Foundations of silviculture, of course, is a synthesized discipline, based upon the more fundamental subjects of soils, botany, physics, chemistry, etc. The job of silvics is to interpret these subjects rather than to discourse fully upon them.

In a good many instances, the presentation of research results seems overly neutral or indefinite. For instance, on pages 28 and 29, advanced scientific findings on light quality are presented. Conclusions of the different investigators are more or less contradictory as well as difficult for college undergraduates to comprehend. Either additional space should have been taken to explain to readers the positive significance of the conclusions, or the material should have been curtailed to a simple statement that light quality had been studied by certain investigators. The latter alternative is recommended because students having need for specific information can turn to the original publications cited. Again, on page 341, "Definitions of Tolerance," four different definitions of tolerance are given, yet no clue is given the reader as to which should be accepted.

The statement on page 79, attributed to Mason, that coal burned in smelters is injurious to trees, is incorrect. The injurious fumes from the Anaconda copper smelters upon which Mason reported were generated from the ore, rather than the fuel, which in this instance was not coal. Mason's writings make no reference to the use of coal.

The treatment of fire on pages 99 and 100 (Effect of Fire on Forest Soil) and on pages 180 and 181 (Biotic Factors—Fire) is inadequate. The profound and far-reaching effects which fires have had in determining the composition, density, and age-class distribution of most American forests are almost wholly unrecognized. Fire might more logically have been elevated to a separate chapter as one of the major physical factors (not biotic). No recognition is given to the fact that many past fires have been beneficial. Instead, it is stated, ". . . uncontrolled fire is always harmful"!

The section "Modification of Site Factors in Silvicultural Practice" is particularly good. It should be of great help to forestry students in appreciating the need for an understanding of fundamentals. It could well be given special emphasis by teachers who employ *Foundations of Silviculture* as a textbook.

RUSSELL K. LEBARRON and C. A. WELLNER,
Northern Rocky Mountain Forest and Range Experiment Station.

Oak Wilt—A Serious Disease in Iowa. By S. M. Dietz and Roy A. Young. 20 pp. Illus. Iowa Agric. Expt. Sta. Bul. P. 91. Iowa State College, Ames, Iowa. 1948.

Foresters in both the Central States and the Lake States have a relatively new and virulent disease of oaks to combat. For several years oaks in Iowa and Wisconsin died from an unknown cause. Investigations were made to detect the cause of death, and to appraise the threat to native oak stands. In Iowa the investigations took a practical turn toward experimental cutting and removal of infected trees to learn what measures were needed to control the disease. The present bulletin reports some of the results of these studies.

The oak wilt (*Chalara quercina*, Henry) is a fungus that is attacking members of both the white and black (red) oak groups in Minnesota, Wisconsin, Illinois, Iowa, and Missouri. In greenhouse inoculations all 11 species native to Iowa were susceptible; some 17 other oak species of more southern and eastern distribution likewise proved susceptible. The threat and potential effect of this disease on many of the hardwood stands in the eastern half of the country are very great.

Apparently the disease is very contagious. An uninfected tree can contract the wilt by a mere scraping or bruising from branches of an infected tree as it is felled. Wood tools can transmit it. Northern red oak, one of our valuable species, shows unusual susceptibility and can die in 30 to 60 days following infection. The authors point out the symptoms of infected trees, and report their experience and recommendations for control.

With such a dangerous disease abroad, foresters will do well to review again their appraisal of some of the less important species. In some stands, lack of disease control may result in the loss of considerable portions of the oak growing stock. In these stands, species other than oak may become predominant. Mixed stands, therefore, appear to promise greater safety in the long run than pure oak stands.

Foresters are urged to get a copy of this bulletin and to acquaint themselves with the oak wilt. References provide other sources of information regarding the disease. The reviewer looks forward to a more complete report on the research done in Iowa on this disease.

L. F. KELLOGG,
Central States Forest Experiment Station.

Current Literature

Compiled by MARTHA MEELIG, *Librarian*
The New York State College of Forestry

Range Management Section Compiled by
FRANCES FLICK, *Library, U. S. Department of Agriculture*

General

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Manual of Cultivated Plants, rev. ed. By L. H. Bailey. Illus. Macmillan Book Co., New York 11. May, 1949. About $18.

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Logging and Milling

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Society Affairs

Officers and Members of the Council—1948-1949

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U. S. Department of Agriculture,
Washington 25, D. C.

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This Is S.A.F. Election Year. First Call for Nominations

All members are hereby notified that the regular biennial election will be held next December 10. A president, vice president, and nine other members of the Council will be elected for the two-year term 1950-1951.

The present Council is listed in the box above. Any or all of these incumbents may be renominated, provided they accept the nomination in writing.

President Martin has announced that he will not be a candidate for reelection.

Vice president Charles F. Evans of Atlanta, Ga., has been nominated by petition for the office of president, and has accepted the nomination.

Membership on the Council is restricted by the Constitution to Members (formerly Senior Members) and Fellows. Any Member or Fellow is eligible to hold office who is in good standing and who accepts the nomination in writing and declares his willingness to serve if elected.

Each voter will have an opportunity to ballot on all candidates for office. Candidates for the office of president are voted on separately; the candidate who receives the highest vote is declared elected president, and the candidate who receives the next highest vote is declared elected vice president.

The nine remaining Council members are elected in accordance with the system of proportional representation. The procedure of proportional representation will be explained in a later issue of the JOURNAL. It is the system by which the Society has been electing Council members for the past decade.

How Nominations Are Made

The Constitution (Article VIII, Section 2) states the conditions under which nominations are made by petition.

1. Each petition shall name but one candidate.
2. All candidates must be eligible to hold elective office.
3. A petition shall bear the signatures of at least ten voting members who at the time of signing the petition are eligible to vote in the coming election. (Eligible voting members are Junor Members, Members, and Fellows in good standing.)
4. A voting member may not sign more than one nominating petition for member of the Council.
5. Petitions must be in the hands of the Nominating Committee by October 15.

The Society has no special form for submitting nominating petitions. They may be written as follows:

"We, the undersigned voting members of the Society of American Foresters, hereby nominate John Doe, a Member (or Fellow), for the office of president (or member of the Council) for the two-year term 1950-1951."

All nominating petitions should be sent

TABLE 1.—DISTRIBUTION OF COUNCIL MEMBERS BY STATES DURING PERIOD 1937-1949
(Presidents' names are in capital letters; vice-presidents', in italics)

State	1937-1938	1938-1939	1940-1941	1942-1943	1944-1945	1946-1947	1948-1949
Alabama				Smith, H. A.			
California	Kotok, E. I.	Krueger, M.	Krueger, M.	Keen, F. P. Baker, F. H.	Keen, F. P. Baker, F. H.		Nelson, DeW.
Colorado			Peck, A. C.	Peck, A. C.			Seneer, J. W.
Connecticut	CHAPMAN, H. H.	Bryant, R. C.[1]	Hawley, R. C.	Hawley, R. C.	Hawley, R. C.		
District of Columbia	Collingwood, G. H.		*Kotok, E. I.*	Behre, E. C.			McArdle, R. E.
Georgia		Kircher, J.				Evans, C. F.	*Evans, C. F.*
Idaho		Jeffers, D.				Evenden, J. C.	Evenden, J. C.
Illinois						Coffman, J. D.	
Iowa		MacDonald, G.	MacDonald, G.				
Louisiana			Eldredge, I. F.	Eldredge, I. F.			
Maryland	Besley, F. W.						
Massachusetts	Shepard, W.	Cline, A. C.					
Michigan	*Dana, S. T.*		Allen, S. W.	*Allen, S. W.*	*Allen, S. W.*	ALLEN, S. W.	
Minnesota				SCHMITZ, H.	SCHMITZ, H.		
Montana	Koch, E.		Gisborne, H.	Gisborne, H.	Smith, G.		
New Hampshire						Herr, C. S.	Herr, C. S.
New York	Spring, S. N.	*Howard, W. G.*	Howard, W. G.	Howard, W. G.	Recknagel, A.	Recknagel, A.	
North Carolina	Rhoades, V.	KORSTIAN, C. F.	KORSTIAN, C. F.		Damtoft, W.	Damtoft, W.	
Oregon		Brundage, F. H.				Dunn, P. M.	Dunn, P. M.
Pennsylvania		Round, H. F.[2]	McIntyre, A. C.		Shirley, H. L.		
South Carolina							Flory, C. H.
Tennessee		Baker, W. M.					Baker, W. M.
Utah	Rutledge, R. H.	Rutledge, R. H.					
Washington	Winkenwerder, H.				Greeley, W. B.	Greeley, W. B. *Martin, C. F.*	Greeley, W. B. MARTIN, C. F.
Wisconsin					Price, J. H.	Price, J. H.	

[1]Died February, 1939.
[2]Succeeded Bryant, deceased.

promptly to the Society's executive office. The names of all candidates will be announced monthly in the JOURNAL as petitions are received.

Nominating Committee

According to the Constitution (Article VIII, Section 1) a Nominating Committee has been appointed by President Martin. The Committee is composed of the following members:

Chairman, William W. Nace, Soil Conservation Service, Oakland, Md.

Merrill E. Deters, University of Idaho, Moscow.

R. Bruce MacGregor, Southern Pine Association, Macon, Ga.

Charles R. Ross, State Extension Service, Corvallis, Ore.

Harry W. Woodward, State Department of Game, Fish and Parks, Custer, S. Dak.

This committee is charged with the following duties:

1. To set the date of the election. (December 10 is the date.)

2. To provide for at least two candidates for the office of president, and at least nine candidates for membership on the Council.

3. To receive separate nominating petitions for the office of president and for each member of the Council, and to supplement such petitions when necessary with other nomnations in order to comply with item *2* above.

The Nominating Committee will make no nominations of its own unless the voting membership fails to make the required minimum number of nominations by petition. Voting members should accordingly get busy and make their own nominations. For their information the distribution of Council members by states during the period 1937-1949 is shown in Table 1.

The Coming Election of Fellows. How Fellow Nominations Are Made

All Members (formerly Senior Members) and Fellows of the Society are hereby advised that nominations for the grade of Fellow are now open. The election of Fellows will be held at the time of the Society's regular biennial election next December 10.

As defined by the Constitution (Article III, Section 6), "Fellows shall be foresters of outstanding achievement as leaders in responsible directive or distinctive individual work of a fruitful character. They shall be elected from the Members and shall be engaged in forestry work at the time of their election."

Nominations Are Made by Petition

The procedure for placing Members in nomination for the grade of Fellow is by petition. The Society has no printed form for this purpose; the petition may be typewritten thus:

"We, the undersigned Members and Fellows of the Society of American Foresters, hereby nominate ———————— to the grade of Fellow for the regular election of 1949."

Remember these simple rules:

1. A petition may not name more than one candidate.

2. It must be signed by 25 Members or Fellows in good standing.

3. It should be accompanied by a factual, not eulogistic, biographical sketch of at least 200 words giving an account of his professional career and accomplishments.

4. It must be received in the executive office of the Society in Washington, D. C., not later than October 15.

The executive employees of the Society cannot be responsible for obtaining signatures on partially completed petitions or on petitions incomplete by reason of unacceptable signatures (that is, signatures of other than Members and Fellows in good standing).

Election Procedure

Fellows are not elected by the membership at large, but by a board of electors which consists of all present Fellows and the present Council. (A Council member who is also a Fellow has but one vote.)

A form of preferential voting is prescribed by the Constitution and Bylaws by which the electors indicate first, second, and third choices. The system is described in Bylaw 21. To win election a candidate must receive an affimative vote of not less than one-half the total eligible votes cast.

Significance of the Grade

The highest distinction that can be conferred on a member by the Society, this grade is awarded in recognition of outstanding achievement. Fellows do not pay increased dues; their dues are the same as those of Members.

Since the Society was founded in 1900, there have been 66 Fellows elected. At the present

time the number of living Fellows is 50. Since the last election in December 1947, four Fellows have died: William G. Howard of New York; Aldo Leopold of Wisconsin; G. A. Pearson of Arizona; and Hugo Winkenwerder of Washington.

List of Fellows

The current roster of Fellows follows. The state in which each Fellow is domiciled and the year of his election are shown after his name.

Allen, S. W. Michigan. 1948.
Baker, H. P. Massachusetts. 1948.
Bates, C. G. Minnesota. 1940.
Besley, F. W. Maryland. 1940.
Butler, Ovid. Maryland. 1940.
Carter, E. E. District of Columbia. 1942.
Chapman, H. H. Connecticut. 1922.
Cheyney, E. G. Florida. 1944.
Clapp, E. H. Maryland. 1930.
Coffman, J. D. District of Coumbia. 1946.
Dana, S. T. Michigan. 1935.
Eldredge, I. F. Louisiana. 1942.
Fischer, A. F. California. 1940.
Frothingham, E. H. California. 1942.
Gifford, J. C. Florida. 1942.
Gill, Tom. District of Columbia. 1948.
Girard, J. W. Oregon. 1944.
Granger, C. M. District of Columbia. 1946.
Graves, H. S. Connecticut. 1918.
Greeley, W. B. Washington. 1918.
Guthrie, J. D. Virginia. 1942.
Hall, W. L. Arkansas. 1940.
Hawes, A. F. Connecticut. 1939.
Hawley, R. C. Connecticut. 1942.
Holmes, J. S. North Carolina. 1939.
Hosmer, R. S. New York. 1932.
Illick, J. S. New York. 1946.
Jeffers, D. S. Idaho. 1948.
Kinney, J. P. District of Columbia. 1942.
Koch, Elers, Montana. 1940.
Korstian, C. F. North Carolina. 1942.
Lowdermilk, W. C. California. 1948.
MacDonald, G. B. Iowa. 1944.
Marsh, R. E. District of Columbia. 1948.
Martin, C. S. Washington. 1948.
Mason, D. T. Oregon. 1948.
Mulford, Walter. California. 1939.
Munger, T. T. Oregon. 1946.
Peavy, G. W. Oregon. 1939.
Peck, A. S. Colorado. 1946.
Preston, J. F. Maryland. 1948.
Schmitz, Henry. Minnesota. 1940.
Show, S. B. District of Columbia. 1948.
Siecke, E. O. Texas. 1946.
Sparhawk, W. N. New Hampshire. 1946.
Spring, S. N. New York. 1939.
Watts, L. F. District of Columbia. 1946.
Winslow, C. P. District of Columbia. 1942.
Wirt, G. H. Pennsylvania. 1948.
Zon, Raphael. Minnesota. 1918.

The White Pine Blister Rust Control Problem in Northern Minnesota[1]

Under what conditions is white pine blister rust control justified in northern Minnesota? To answer this question a subcommittee made up of representatives of the U. S. Forest Service, Minnesota Forest Service, Bureau of Entomology and Plant Quarantine, and forest industry was set up in the Forest Protection Committee of the Upper Mississippi Valley Section of the Society of American Foresters. It was decided to study the problem on the ground under actual field conditions within the so-called 14 cut-over counties of northern Minnesota.

How the Study Was Made

In the fall of 1947 the committee visited and studied several areas typical of (1) north central Minnesota which is characterized by good accessibility, close markets and average ribes conditions; and (2) northeastern Minnesota where accessibility is poor, markets are limited, and particularly heavy ribes concentrations and optimum climatic and other physical conditions are especially favorable for infection of white pine.[2] At each area the problem was discussed and the results measured by a common yardstick of values based on (1) the cost of control as compared with the expected returns from the protected white pine or other commercially important species now present on the area, or (2) a comparison with the cost of planting desirable species, such as red pine, that are not susceptibel to white pine blister rust and considering losses from delay in attempting to establish a new stand.

It was accepted at the outset and confirmed by the observations made that effective blister rust control work can be done, as has been dem-

[1]The white pine blister rust control program in Minnesota has been the subject of comment and criticism at several Section and Sub-section meetings. Early in 1947, therefore, there was organized a sub-committee of the Forest Protection Committee to review the past work, present work, and future plans and problems of the blister rust control program. The findings and recommendations of the Forest Protection Committee's White Pine Blister Rust Sub-committee of the Upper Mississippi Valley Section are the subject of this paper.

[2]The committee wishes to express its appreciation to Lawrence Ritter and Don M. Stewart of the Bureau of Entomology and Plant Quarantine for their assistance in furnishing case histories on typical areas and for their contributions to the discussions during the field trips, and to Dr. Frank Kaufert of the University of Minnesota for his comments and the use of the report "Epidemiology Studies of White Pine Blister Rust in the Lake States in 1934" by L. J. Tyler and Frank Kaufert.

onstrated in Minnesota and other states. Principal attention was devoted to determining where it seems advisable to spend what it costs to get the job done.

Summary of Findings

A precise formula for determining when blister rust control work can be recommended has not been developed. Instead, the various factors that should be considered have been summarized so that each agency or individual can determine the work that is justified on the basis of white pine values correlated with local conditions affecting market values of timber, recreation, scenic values, protection costs, etc. Upon the basis of the following findings each can develop his own formula for employee guidance:

1. Organizations, both public and industrial, which are responsible for the management of white pine producing areas should weigh cost of protection against expected incomes and other values received before embarking on a costly eradication program. In the past, too little attention has been paid to this phase of the problem and consequently funds have been expended on areas which will not produce sufficient income or which do not involve sufficient values to justify the costs.

2. The land manager not only should carefully weigh the cost of blister rust control against expected results but also should correlate it with needs for control or other enemies. For instance, in many plantations and natural reproduction areas there seems to be as much damage from deer and rabbits as is evident from blister rust. It seems unwise to spend money for the control of a disease if necessary protection against deer, rodents or other pests cannot be secured at a reasonable cost.

3. Blister rust control work on private lands (other than protection for adjoining public lands) should be limited to work which the owner is willing to finance for protection. This would mean the assumption of labor costs by the owner with adequate supervision by a trained foreman and technical advice from public officers. In young immature stands which would be held 10 years or more before any merchantable products could be cut, control work should be encouraged under the provisions of the Lea Act of April 1940. This law authorizes the government to share costs of labor on a matching basis and to provide trained supervision and technical advice.

Government expenditures for work planned on county lands should be limited to the areas that are properly organized and managed to remain in public ownership as forest property. Those lands available for purchase by private owners should be handled in the same manner as other private lands.

4. Any control work planned for publicly owned areas should be based on the following considerations:

(a) *Present percent of infection in the stand.* Obviously a stand heavily infected is usually not worth protection because of the inevitable loss that can be expected. Any *visible* infection of 40 percent or over usually means an excessive loss in a short time. Percent of infection is also affected by consideration of the factors listed below, which should receive full consideration in determining exceptions to this rule of thumb.

(b) *Number of stems per acre.* Control should be limited to areas having sufficient stocking of white pine to permit the areas reaching maturity with a fairly well stocked stand or to areas which have an adequate seed source permitting restocking and subsequent replacement of trees currently infected. This applies particularly to sites suitable primarily for white pine and also to stands not supporting commercially valuable species adapted to the site.

(c) *Size and age of the stand.* In general, work should be concentrated in reproduction, sapling and pole stands on good sites in order to prevent losses before the timber reaches sizes permitting salvage and improvement cuts. Usually control work in sawlog stands is not desirable or necessary. The chances of mortality are reduced since infected side limbs will often shade out and die before the infection can spread to the main stem and there is usually an opportunity to salvage trees that do succumb or are badly infected. In areas of special value and light ribes concentration, it may be desirable to do control work as insurance against increased risks and the possibile loss of thrifty mature trees.

(d) *Cost of establishing a stand to a species other than white pine.* Cut-over areas containing white pine reproduction, or on which white pine reproduction is expected within two or three years, will not be considered for control work unless the cost of control is less than the cost of establishing a stand of another suitable species, such as white spruce or red pine.

(e) *Ribes conditions present and expected.*

Areas of heavy concentrations of ribes with poor natural screening against the spread of spores should be dropped from consideration since cost of control is prohibitive and efficiency is low. This situation is influenced by species of ribes, topography, etc., and can best be defined and measured in terms of cost of eliminating ribes from the stand and protection zones. It recognizes the common practice that develops among blister rust control crews in classifying chances as difficult, medium or light. This in turn is affected by techniques in control which are gradually being improved. An area that is too costly to control today may be a satisfactory chance several years hence.

(f) *Climatic conditions.* Certain areas, such as those immediately adjacent to the shore of Lake Superior, have peculiarities of climate which favor pine infection. In these areas effective control is rarely feasible. This has been recognized in the past and should be borne in mind when investigating other areas in the future. It is expected that similar conditions may be found in other portions of the state.

(g) *Management plans for the area in question.* Scattered white pine in jack pine and red pine stands *being managed for jack pine or red pine production* should not be considered as worthy of protection even though the cost of control is small. The amount of loss due to blister rust is ordinarily small and, since white pine is in the minority, it should not be considered as warranting control work. Likewise, management for production of white pine should be limited to areas where control work can be accomplished at a reasonable cost, and this should usually be limited to natural stands since planting of white pine in northern Minnesota can not be recommended except in areas known to be ribes free. The only exception to this will come in areas already supporting some white pine which has been protected and will justify continued protection.

(h) *Consideration of special values i.e., scenic, recreational, roadless, "no-cut," and experimental areas.* These will require special treatment according to the restrictions of management placed on them. Ordinarily if the timber is not to be harvested, no protection funds should be expended other than those sufficient to protect outstanding scenic values or recreational developments which are receiving heavy use by the public. Where scenic features are not dependent upon the white pine and attractive stands of other conifers and hardwoods are present, it is not considered good business to attempt protection of the white pine where it will not be harvested because of restricted management.

(i) *Accessibility and markets for products resulting from improvement, salvage and final cuts.* Good market conditions and accessibility of timber that is dead or dying should have a decided effect on the intensity of control practiced on the area. Likewise, good market conditions and accessibility will permit the current salvage of timber that is dead or dying as a result of disease attack. While good market conditions and accessibility might add value for white pine which would justify protection, these same factors would enhance values of other associated species, if they are present. The determination of when to protect or not protect, therefore, will go back to other considerations involving costs in relation to expected returns and dependence upon white pine for keeping the area productive.

Agencies are urged to establish minimum requirements based on their plans for manage ment and peculiarities of the area particularly as to accessibility and markets. Future surveys to determine areas for control work should be based on a set of minimum requirements and not merely on the presence of white pine.

(j) *Presence of other merchantable associated species.* Generally speaking where other desirable species, such as red pine, are present on an area in association with white pine, the need for control becomes greater as dependence upon white pine for adequate stocking increases. Conversely if a well stocked stand of rust-free species, well adapted to the site, such as red and jack pine, can be developed, control should not be attempted.

5. Considerable research work has been done and should be continued in the following fields:

(a) Developing rust resistant strains of white pine.

(b) Finding cheaper and more effective methods of control by the use of chemicals and other means.

(c) Further developing the technique of canker pruning in stands already infected, with a view to halting the spread of infection and improving the quality of the stand.

6. Future planting of white pine should be limited and based on a careful appraisal of the blister rust problem in each locality. All those

who may purchase white pine planting stock within the State should be informed of possible blister rust damage and the general use of such stock should be discouraged. This is especially timely since recent legislation, permitting sale of planting stock from State nurseries, will result in an expanded planting program. Failure of white pine plantations because of blister rust damage could seriously deter progress in private reforestation within the state.

7. Minimum size of white pine blocks considered for protection should be 20 acres within an individual ownership class, i.e., private, state or federal. The only exception to this might occur in small highly used recreational areas or scenic strips of exceptional importance, or where cooperative work agreements and contributing fund deposits have been negotiated.

General Conclusions

In general it is felt that the blister rust control program has been subjected to unjustified criticism. On the one hand it has done creditable work where it has been accused of wasted effort and on the other hand, in the enthusiasm to control white pine blister rust wherever there is white pine, work has been done which cannot now be justified in the light of costs and values involved. Much of the work accomplished to date in northern Minnesota lies somewhere on middle ground, especially where emergency work crews on CCC and WPA programs were used to good advantage where work with small hand tools in areas accessible to population centers was an important consideration for unemployment relief. Plans for future work appear to give adequate recognition to cost considerations, and the whole program is getting the attention from administrative agencies which it deserves.

What about future blister rust control in northern Minnesota? Already some of the projects which were at one time scheduled for work, especially those within restricted management areas on the Superior National Forest, have been dropped, and the Committee endorses this action. This refers particularly to special areas where scenic values are the principal consideration and stands of mixed hardwoods and conifers other than white pine will provide an attractive landscape.

The degree to which protective work is approved or disapproved should be left entirely with the administrative agency responsible for jurisdiction over the area. Within the past several years there has been an increasing interest on the part of administrative agencies in reviewing proposals of the blister rust control personnel and determining which projects will be approved. This change seems to be a desirable and welcome one to blister rust control people and its continuation and extension is to be encouraged.

MIKE GUTHRIE,
J. N. LICKE,
FRANCIS MOORE,
PAUL J. ST. AMANT,
BERNARD M. STOUT,
MARVIN L. SMITH, *Chairman.*

Election of Candidates to Membership

The following names of candidates for membership are referred to the membership for comment or protest. The list includes all nominations received since the publication of the February JOURNAL without question as to eligibility. Names, addresses, education, and endorsements are given. The names have not been passed upon by the Council. Important information regarding the qualifications on any candidate which will enable the Council to take final action with a knowledge of essential facts should be submitted before April 1, 1949. Statements on different men should be submitted on different sheets. Communications relating to candidates are considered as strictly confidential.

Allegheny

Junior Membership

Brown, Loren R., Asst. Forester, Dept. of Forests and Waters, Harrisburg, Pa.; Pa. State, B.S.F., 1938. Reinstatement.

Chrisler, Donald, Asst. Dist. Forester, Dept. of State Forests & Parks, Annapolis, Md.; Univ. of Mich., B.S.F., 1948. W. H. Johnson, C. J. Pickall, C. Stravinski.

Cunningham, G. R., Grad. Asst., Pa. State, State College, Pa.; Mich. State, B.S.F., 1948. V. A. Beede, H. Norton Cope, W. C. Bramble.

Appalachian

Junior Membership

Durham, G. V., Farm Forester, N. C. Dept. of Cons., Raleigh, N. C.; N. C. State, B.S.F., 1949. W. D. Miller, C. M. Kaufman, L. Wyman.

Moreland, D. E., Grad. Student, N. C. State, Raleigh, N. C.; N. C. State, B.S.F., 1949. C. M. Kaufman, R. J. Preston, Jr., L. Wyman.

Nugent, B A., Forester, S. C. Natl. Forest, Newberry, S. C. Appalachian.

Central Rocky Mountain

Junior Membership

Mogren, E. W., Instr., Colo. A. & M., Ft. Collins, Colo.; Univ. of Minn., B.S.F., 1947; M.F., 1948. R. C. Bryant, J. V. K. Wagar, J. L. Deen.

Central States

Junior Membership

Brenneman, W. S., Forestry Asst., Consumer's Power Co., Jackson, Mich.; Mich. State, B.S.F., 1948. G. D. Blair, R. H. O'Neil, P. A. Herbert.

Kelsey, F. B., Dist. Forester, Ind. Div. of Forestry, Indianapolis, Ind.; Purdue, B.S.F., 1941. R. C. Brundage, J. L. Van Camp, T. E. Shaw.

MacAllister, J. G., Dist. Farm Forester, Ind. Div. of Forestry, Indianapolis, Ind.; Cornell, B.S.F., 1934. R. C. Brundage, J. L. Van Camp, T. E. Shaw.

Member Grade

Green, Burdett, Sec.-Mgr., American Walnut Mfrs. Assoc., Chicago, Ill.; Univ. of Mo., B.S.(Forestry), 1921; Yale, M.F., 1922. Central States (Jr. member, 23R45).

Liming, F. G., Forester, Central States Forest Expt. Sta., Columbus, Ohio; Ohio State, B.A., 1930; Ph.D., 1935. Central States (A38J48).

Zettle, D. G., Regional Forester, Mich. Dept. of Cons., Lansing, Mich.; Mich. State, B.S.F., 1935; Central States (35R48).

Columbia River

Junior Membership

Cooper, L. J., Dist. Rgr., U.S.F.S., Medford, Ore.; Columbia River.

Easton, M. H., Asst. Cons. Instr., State Board of Forestry, Salem, Ore.; Oregon State, B.S.F., 1948. James Dick, Paul M. Dunn, W. F. McCulloch.

Mallery, Wright T., Thr. Mgmt. Asst., Umpqua Natl. Forest, Roseburg, Ore.; Oregon State, B.S.F., 1948. M. D. Andrews, M. M. Nelson, W. O. Beuecke.

Young, Cecil M., Partner, Pacific Meat Co., Honolulu, T. H.; Univ. of Mich., B.S.F., 1538. Reinstatement.

Member Grade

Baisinger, D. H., Research Forester, Crown Zellerbach Corp., Portland, Ore.; Univ. of Wash., B.S.F., 1942. Columbia River (Jr. member, 1942).

Burke, M. H., Staff Asst., U.S.F.S., Enterprise, Ore.; Utah State, B.S.(Botany), 1928; M.S., 1934. Columbia River (Jr. member, 1936).

Colville, Leslie L., Regional Staff Officer, U.S.F.S., Portland, Ore.; Univ. of Mont., B.S.F., 1924. Columbia River (Jr. member, 1926).

Dick, James, Tech. Asst., Oregon State Board of Forestry, Salem, Ore.; Univ. of Idaho, B.S.F., 1941; M.S., 1947. Columbia River (Jr. member, 1944).

Rowbury, J. G., Coos Bay Pulp Corp., Empire, Ore.; Univ. of Calif., B.S., 1938; Univ. of Mich., Ph.D., 1948. Columbia River (Jr. member, 1939).

Gulf States

Junior Membership

Judson, George M., Forester, U.S.F.S., New Orleans, La.; N. Y. State, B.S.F., 1535. E. B. Williams, S. F. Clarke, E. A. Hebb.

Inland Empire

Junior Membership

Morgan, Robert S., Forester, Kaniksu Natl. Forest, Sandpoint, Idaho; Univ. of Mont., B.S.F., 1948. C. K. Lyman, M. C. Riley, H. J. Faulkner.

Sanderson, J. E., Dist. Rgr., Coeur d'Alene, Idaho; Mont. State, B.S.F., 1943. K. P. Davis, O. M. Patten, J. P. Drummond.

Seaberg, D. R., Forester, U.S.F.S., Orofino, Idaho; Univ. of Idaho, B.S.F., 1946. E. F. Barry, A. B. Curtis, G. V. Hjort.

Williams, D. F., Supv., Bur. of Ent. & Plant Quar., Spokane, Wash.; Univ. of Minn., Forestry (3 yrs.). Inland Empire.

Zink, R. M., Farm Forester, Dept. of Forestry, Orofino, Idaho; Univ. of Me., B.S.F., 1948. R. L. Guernsey, E. F. Barry, G. V. Hjort.

Intermountain

Junior Membership

McGinnies, W. J., Forester, Int. For. & Range Expt. Sta., Ogden, Utah; Colo. A. & M., B.S.(Forestry), 1948. J. L. Deen, W. H. Schaeffer, R. C. Bryant.

New England

Junior Membership

Logan, B. A., Asst. Woods Mgr., Howard Smith Paper Mills, Ltd., Montreal, Canada; Univ. of New Brunswick, B.S.F., 1933. New England.

O'Donnell, J. E., Jr., Forester, Hollingsworth & Whitney Co., Waterville, Me.; Dartmouth College, B.A., 1943; Yale, M.F., 1948. H. H. Chapman, F. E. Dickiman, E. V. Zumwalt.

Member Grade

Allen, Robert K., Dist. Forester, Dept. of Lands and Forests, Halifax, Nova Scotia; Univ. of New Brunswick, B.S.F., 1937. Reinstatement.

Mullin, G. B. P., Forester, Northeastern For. Expt. Sta., Upper Darby, Pa.; Yale (Certificate), 1930. New England (Jr. member 31R49).

New York

Associate Membership

Bray, Joseph M., Mining Engr., Osmose Wood Preserving Co., Buffalo, N. Y.; Pa. State, B.S., (Geology), 1937; Mass. Inst. of Tech., Ph.D., 1940. New York.

Junior Membership

Phillips, H. D., Forest Engr., St. Regis Paper Co., Deferiet, N. Y.; New York State, B.S.F., 1948. D. P. Lum, Jr., C. F. Baar, C. D. Kingsbury.

Richards, R. E., Acting Blister Rust Dist. Leader, New York State Cons. Dept., Albany, N. Y.

Skinner, L. R., Forest Gen. Foreman, New York State Cons. Dept., Albany, N. Y.; Cornell, B.S.F., 1917. D. S. Findlay, D. B. Cook, J. C. Robert.

Member Grade

Bowker, G., Teacher, Dendrology Instructor, Paul Smith's College, Paul Smiths, N. Y.; Univ. of Mich, B.S.F., 1947; M.F., 1947. New York (Aff. 42J48).

Northern California

Junior Membership

Sperry, Ronald D., Thr. Cruiser, Rockport Redwood Cty., Rockport, Calif.; Univ. of Calif., M.F., 1947. E. S. Baker, Emanuel Fritz, A. W. Sampson.

Member Grade

Colwell, W. L., Jr., Forester, Calif. Forest & Range Expt. Sta., Berkeley, Calif.; North Carolina State, B.S.F. 1938. Northern California (Jr. member, 1938).

Northern Rocky Mountain

Junior Membership

Hodge, William C., Forester, N. Rky. Mt. Expt. Sta., Missoula, Mont.; Mont. State, B.S.F., 1943. H. T. Gisborne, B. M. Huey, S. B. Hutchison.

Ozark

Junior Membership

Livens, W. H., Dist. Rgr., Clark Natl. Forest, Rolla, Mo.; Univ. of Minn., B.S.F., 1936. R. W. Steidemann, D. W. Smith, F. W. Meyers.

Puget Sound

Junior Membership

Dick, M. R., Cruiser, Weyerhaeuser Thr. Co., Tacoma, Wash.; Univ. of Wash., B.S.F., 1939. F. C. Reed, J. W. Coskey, M. Turay.

Maki, A. T., Forest Practices Forester, Wash. State Div. of Forestry, Olympia, Wash.; Mich. College of Mining & Tech., B.C.(Forestry), 1948. Puget Sound.

Maycock, C. P., Dist. Forest Rgr., U.S.F.S., Juneau, Alaska; Utah State, B.S.F., 1946. C. H. Forward, C. G. Burdick, C. M. Archbold.

Soderberg, P. E., Forester, Biles Coleman Lbr. Co., Omak, Wash.; Univ. of Wash., B.S.F., 1939. G. D. Marckworth, O. H. Schrader, Jr., B. L. Ovell.

Southwestern

Junior Membership

Bowman, E. E., Forester, Navajo Service, Window Rock, Ariz.; Colo. A. & M., B.S.F., 1948. H. Weaver, J. V. Chiarella, C. O. Lindh.

Morlock, J. F., U.S.I.F.S., Whiteriver, Ariz.; Iowa State, B.S.F., 1947. H. Weaver, M. C. Collins, C. Otto Lindh.

Rehfeldt, R. F., Forester, U. S. Indian Forest Service, Whiteriver, Ariz.; Iowa State, B.S.F., 1948. H. Weaver, M. C. Collins, F. R. Moffat.

Upper Mississippi Valley

Affiliate Membership

Walde, E. S., Ranger, Appraiser & Scaler, Iron Range Resources and Rehab., Clearwater County, Minn.; Univ. of Idaho (1 yr.). Upper Mississippi Valley.

Junior Membership

Bergeron, J. R., Forester, Iron Range Resources & Rehab., Univ. of Minn., B.S.F., 1948. R. M. Brown, J. H. Allison, L. W. Rees.

Chern, Joseph, Forester, Iron Range Resources & Rehab., St. Paul, Minn.; Univ. of Minn., B.S.F., 1948. R. M. Brown, J. H. Allison, L. W. Rees.

Holmes, C. A., Research and Development, Halverson Trees, Duluth, Minn.; Univ. of Minn., B.S.F., 1948. D. Worrall, R. M. Brown, L. W. Rees.

Member Grade

Seeley, H. M., Forester, Lake States Forest Expt. Sta., St. Paul, Minn.; Mich. State, B.S.F., 1940; M.F., 1946. Upper Mississippi Valley (Jr. member, 1941).

Washington

Associate Membership

Davidson, Ross W., Plant Path., U.S.D.A., Beltsville, Md.; Ottawa Univ., B.S.(Biology), 1927; Univ. of Iowa, M.S., 1928. Washington.

Fowler, M. E., Path., U.S.D.A., Beltsville, Md.; Central College, A.B.(Botany), 1926; G.W. Univ., M.A., 1931. Washington.

Member Grade

Romeiser, G. C., Asst., Natl. Lbr. Mfrs. Assoc., Washington, D. C.; Purdue, B.S.F., 1939. Washington (Jr. member, 1940).

Wisconsin-Upper Michigan

Affiliate Membership

Christiansen, Philip C., Forest Mgr., C. M. Christensen Co., Phelps, Wis.; Lawrence College, B.S., 1943. Wisconsin-Upper Michigan.

Junior Membership

Wells, Sidney D., Engr. Forest Prods., U.S.F.S., Madison, Wis.; Mass. Inst. of Tech., B.S., (Chem. Engr.), 1907. Reinstatement.

Member Grade

Romnes, Ragner, Dist. Forester, Dept. of Cons., Hayward, Wis.; Univ. of Minn., B.S.F., 1935. Wisconsin-Upper Michigan.

Elections to Membership

Affiliate

Bousquet, D. E., N. Y.
Brown, D. E., La.
Clason, D. C., Minn.
Hammerschmidt, R. C., Mich.
Escola, E. S., Calif.
Henson, S. L., Ala.
Sanders, Z. L., Ala.
Wagner, H. J., Wis.
Walker, L. A., Ark.

Associate

Leslie, R. E., La.
Rich, L. R., Ariz.

Junior

Ambrosen, D. R., Ga.
Amsler, F. P., Ga.
Benson, F. M., Jr, Tex.
Bissett, O. R., Mass.
Campbell, R. A., Miss.
Chamberlain, A. R., Jr., Mass.
Chamberlain, E. B., Pa.
Christensen, E., N. Y.
Colburn, F. O., Minn.
Cole, A. B., Mass.
Coleman, D. E., Jr., Ga.
Colson, J. H., Ga.
Dunwoody, C. B., R. I.
Evans, A. E., Miss.
Franklin, F., Colo.
Furney, J. E., Ga.
Furnival, G. M., Miss.
Gipson, R. E., Tex.
Gnann, J. W., Ga.
Griffith, M. J., S. Dak.
Hall, O. F., Minn.
Hamilton, R. E., Ill.
Harris, W. O., Ore.
Harvey, G. M., Idaho
Heeren, G. C., Ill.
Heinselman, M. L., Wis.
Henry, L. G., Calif.
Hill, J. H., Ga.
Hogan, J. J., Ga.
Hosner, J. F., Ill.
Hurt, C. E., W. Africa
James, George S., Calif.
Jacobs, R. M., Minn.
Jongewaard, R. V., Minn.
Kiefer, G. C., Jr., Conn.
King, G. W., Va.
Kittelson, J. M., Minn.
Kriebel, H. B., Vt.
Mathieu, T. F., Mass.
Maupin, W. K., Tenn.
McCarthy, W. H., Ga.
Megnin, V. U., La.
Miller, B. F., N. Y.
Moore, J. W., Ga.
Moore, J. B., Ga.
Patterson, P. K., Me.
Peeples, H. C., Fla.
Pirsko, A. R., Utah
Ray, H. C., Ark.
Roberts, J. R., Jr., Ala.
Robinson, J. C., Wash.
Rowson, L., Minn.
Rowston, W. J., S. C.
Safran, R. L., Utah
Salter, J. M., Jr., Ga.
Sauerwein, W. J., Wash.
Shattuck, J. H., N. Y.
Shaw, N. L., Ga.
Starr, J. W., Ga.
Thom, R. H., Ill.
Wade, R. V., Ga.
Whitfield, F. E., N. C.
Wilkins, J. C., Jr., Ga.
Woolley, J. T., Colo.
Wright, A. C., Colo.
Zabel, R. A., N. Y.

Member

Busch, E. H., Colo.
Cron, R. H., Calif.
Hodges, D. J., Colo.
Jacobs, H. C., Wis.
Kahn, Julius, N. Y.
Lundell, P. G., Colo.
Nicholls, C. O., Calif.
Poch, F. J., Colo.
Pugsley, G. W., Ariz.
Reinhardt, R. E., Ore.
Shoemaker, L. E., Wyo.
Siewert, G. W., Colo.
Smith, A. W., Wis.
Taylor, R.O., Colo.
Terrell, C. L., Colo.
Turner, G. T., Colo.

Corresponding

Torricelli, Edward, Chile

Reinstated

Affiliate

Miller, G. W., Mont.

Junior

Baird, J. C., Colo.
McGuire, K. B., Calif.
Sanders, R. D., Minn.
Snelling, R. E., W. Va.
Travis, J. H., Ore.

Member

Langford, F. M., Tenn.

Society of American Foresters' List of Consulting Foresters

The following list of consulting foresters has been compiled by the Society of American Foresters for the information of prospective clients, especially private woodland owners and operators.

By the publication of this list the Society realizes its professional obligation to protect the interests of the public, but it cannot assume responsibility for the actions of individuals or firms listed. The Society believes that the following individuals and firms are qualified and competent to perform the specialized technical services specified. Proved violation of a contract or agreement to perform specific service by any individual or firm will result in the removal of his name or agency from subsequent lists.

Fields of specialization are identified by code numbers. When a consultant is prepared to render service in a distinct and major field not identified by a code number, the field is specifically mentioned following his name.

Permission to publish or reproduce this list in whole or in part, but without unauthorized additions, is hereby granted. Amended lists will be issued periodically.

Code of Fields of Specialization

1. Arboriculture and tree preservation.
2. Cost and economic studies of forest operations.
3. Forest and wood utilization.
4. Forest management and silvicultural practice.
5. Forest protection from disease.
6. Forest protection from fire.
7. Forest protection from insects.
8. Forest taxation.
9. Game and wildlife management.
10. Logging engineering.
11. Market studies and trade promotion (forest products).
12. Naval stores operations.
13. Pulpwood operations.
14. Range management.
15. Surveying and mapping.
16. Timber valuation and appraisal.
17. Timber volume and quality estimates.
18. Tree planting and reforestation; reproduction studies.
19. Wood preservation.
20. Wood seasoning.
21. Wood technology.

E. P. Ahern, Consulting Forester, Allen, Alabama.
Territory: Southeastern states.
Specialization: 3, 11, 16, 20, 21. Also location of wood-utilizing plants.

D. A. Anderson, Consulting Forester, College Station, Texas.
Territory: Texas.
Specialization: 1, 4, 16, 17, 18.

John D. Atkins, Jr., Hamilton, Virginia.
Territory: Virginia.
Specialization: 4, 16, 17.

S. Gayley Atkinson, Consulting Forester, 311 Colonial Avenue, Roslyn, Pennsylvania.
Territory: Pennsylvania.
Specialization: 1, 18.

Harrison V. Bailey, 8 Ashby Street, Alexandria, Virginia.
Specialization: Consultant in industrial forestry, to industries using forest products, and to importers of precious and fine utility woods, mainly tropical.

Henry L. Bango, Consulting Forester, P. O. Box 145, Minden, Louisiana.
Territory: Northern Louisiana.
Specialization: 3, 4, 5, 16, 17, 18. Also purchase and sale of timbered properties.

George Banzhaf & Company, 662 North Water St., Milwaukee 2, Wisconsin.
Territory: Lake states.
Specialization: 2, 4, 13, 15, 16, 17.

Belanger and Bourget, Land Surveyors, and Forest Engineers, 86 Cote de la Montagne, Quebec, Canada.
Territory: Canada, especially Quebec.
Specialization: 2, 3, 4, 10, 11, 13, 15, 16, 17, 19, 20, 21, and boundary lines.

Bigley and Feiss, Foresters, Inc., 283 Miner Building, Eugene, Oregon.
Territory: Washington, Oregon, and California.
Specialization: 2, 3, 4, 6, 15, 16,; also sustained-yield plans, supervision of contract logging, and timberland sales.

Allen W. Bratton, Consulting Forester, Shelterwood, Cooperstown, New York.
Territory: Northeast.
Specialization: 4, 5, 6, 7, 11, 15, 16, 17, 18.

W. S. Bromley, Consulting Forester and Registered Surveyor, 1017 North Lowell Street, Ironwood, Michigan.
Territory: The Lake states.
Specialization: 2, 3, 4, 10, 11, 13, 15, 16, 17. Also advice on special forestry and land problems confronting private forest land owners in the Lake states.

C. T. Brown, Jr. (see R. C. Rose).

Charles H. Bunting, Timber Cruiser, Room 717, 300 Montgomery Street, San Francisco, California.
Territory: California.
Specialization: Timber cruising, volume and quality; mapping, topographic, timber type, and density; logging engineering, maps, road surveys, estimates; appraisals.

N. D. Canterbury, Consulting Forester, 1612 Ruth Street, Houston 4, Texas.
Territory: Texas.

Capitol Forestry Company, Inc., Consulting Foresters, Stop 19½ Troy Road, Schenectady, New York.
Territory: Northeastern states and eastern Canada.
Specialization: 1, 9, 15, 16. Emphasizing wildlife damage control in connection with 9, and aerial surveys in connection with 16.

Carolina Forestry Co., Inc., Consulting Foresters, Box 341, Clinton, North Carolina.
Territory: Southeastern states; all forest types.
Specialization: 2, 3, 4, 11, 13, 15, 16, 17, 18. Also custom sawing.

Floyd B. Chapman, Game Management Consultant, 1944 Denune Avenue, Columbus 3, Ohio.
Territory: Midwestern states.
Specialization: 9. Also game and wildflower surveys; bird and wildflower surveys; bird and wildflower sanctuaries and nature trails; land-use planning.

Aldis J. Christie, Forester, 14 Wellington Road, Manchester, New Hampshire.
Territory: Southern New Hampshire.
Specialization: 4, 15, 16, 17, 18. Also management plans for municipal water supply watersheds.
Territory: Eastern New York.
Specialization: 4, 8, 9, 13, 16, 18.

David B. Cook, Consulting Forester, 14 Nolan Road, Albany 5, New York.
Territory: Eastern New York.
Specialization: 4, 8, 9, 13, 16, 18.

Philip T. Coolidge, Consulting Forester, 31 Central Street, Bangor, Maine.
Territory: Not limited.
Specialization: 2, 4, 8, 10, 13, 15, 16, 17, 18. Also farm appraisal.

William T. Cox, Consulting Forester—Biologist, 2186 Doswell Avenue, St. Paul 8, Minnesota.
Territory: General.
Specialization: 4, 9, 16. Also appraisals of tropical forest properties including plans for use and development; fur and other wildlife development and management; selection of new, preferably permanent, locations for sawmills, pulp mills, and woodworking plants.

James W. Craig, Consulting Forester, Leavell Woods Substation, Jackson, Mississippi.
Territory: Mississippi and the South.
Specialization: 3, 4, 6, 13, 15, 16, 17, 18.

Keith Cranston, Consulting Forester, 4th and Huddleston, Leland, Mississippi.
Territory: South.
Specialization: 2, 3, 4, 10, 11, 13, 16, 17.

Crosby Engineering & Management Company, Consulting Foresters, Glenwood, Oregon, or Route 10, Box 706, Portland 2, Oregon.
Territory: Pacific Northwest.
Specialization: 2, 10, 15, 16, 17.

John M. Crowl, Consulting Forester, Urbana, Ohio.
Territory: Not limited.
Specilization: 3, 4, 5, 6, 7, 13, 15, 16, 17, 18.

Randle J. Dedeaux, Consulting Forester, P. O. Box 52, Perkingston, Mississippi.
Territory: South Mississippi, longleaf-slash pine types.
Specialization: 4, 13, 15, 17. Also growth studies, timber marking and marketing, and agent for absentee timberland owners.

W. T. Doherty, Consulting Forester, 1020 West Park Avenue, Albuquerque, New Mexico.
Territory: Southwest.
Specialization: 4, 16, 17. Also land classification.

James D. L. Drake, Consulting Forester, Bellingham, Washington.
Territory: Washington, Oregon, British, Columbia.
Specialization: 4, 10, 13, 15, 16, 17, 18. Also forest production problems; seed sales of Pacific Coast and Alaska species; acquisition and management of timberland properties.

William E. Dunham, manager, Southern Foresters (Timberland Consultants), Savannah, Georgia. (Subsidiary of Savannah River Lumber Corporation.)
Territory: Southern region.
Specialization: 2, 3, 4, 5, 6, 7, 8, 9, 13, 14, 15, 16, 17, 18.

William A. Eastman & Company, Inc., Realtors and Consulting Foresters, 410 Green Building, Seattle 1, Washington.
Territory: Washington and Oregon. Douglas-fir and pine types and hardwoods.
Specialization: 2, 3, 4, 5, 6, 7, 10, 15, 16, 17, 18.
Realtor: Timberland brokerage.

Arthur M. Emmerling, Southwestern Forest Associates, P. O. Box 1300, Little Rock, Arkansas.
Territory: Southern Missouri, Arkansas, eastern Oklahoma, and northeastern Texas.
Specialization: 2, 3, 4, 8, 10, 11, 13, 15, 16, 17, 18.

John B. Evans, Consulting Forester, 77 Prospect Street, Lancaster, New Hampshire.
Territory: Northeast.
Specialization: 4, 5, 6, 7, 10, 15, 16, 17, 18.

George M. Fisher, Consultant Forester and Landscape Engineer, 1701 Louisana Street, Lawrence, Kansas.
Territory: Kansas, Missouri, Iowa, and Nebraska.

Specialization: 1, 4, 5, 7, 11, 18. Also farm forestry; city forestry and shade tree problems; plant materials and planting lists; landscape design, construction, and maintenance; forest parks and recreational planning.

Reginald D. Forbes, Consulting Forester, R.F.D. 1. Ambler, Pennsylvania.
Territory: Eastern United States.
Specialization: 4, 6, 17, 18. Also forest resource surveys of timber available to manufacturing plants in specified territories.

Forest Managers, Inc., Consulting Foresters, 1406 First Street, Neptune Beach, Florida.
Territory: Eastern United States and Canada.
Specialization: 3, 4, 6, 8, 12, 13, 15, 16, 17, 18. Also investigations of forest resources for pulp and paper companies. Acquisition and management of timber properties for investors. Registered real estate brokers, dealings confined to forest lands. Represent insurance company in making long-term loans on forest properties of 10,000 acres or more.

Edwin H. Francis, Consulting Forester and Landscape Engineer, Varysburg, New York.
Territory: Western New York.
Specialization: 1, 5, 6, 7, 15, 16, 17, 18. Landscape construction, design, and maintenance.

Emanual Fritz, Consulting Forester. 102 The Uplands, Berkeley, California.
Territory: California; pine and redwood.
Specialization: 2, 3, 4, 6, 10, 11, 16, 17, 18, 19, 20, 21. Also consultant on state forest and park management and policy.

LeRoy Frontz, Consulting Forester, Allenwood, Pennsylvania.
Territory: Eastern United States.
Specialization: 3, 4, 5, 6, 7, 9, 16, 17, 18. Also landscaping, forest and ornamental nurseries, farm forestry, forest parks and recreation, land-use planning, soil conservation, farm valuation and appraisal.

A. R. Gobeil, Consulting Forest Engineer, 13 Place D'aiguillon, Quebec, Canada.
Territory: Quebec.
Specialization: 4, 5, 7, 9, 15, 18. Also landscape engineering and public relations.

Winslow L. Gooch, Forestry Consultant, West Point, Virginia.
Territory: United States, Central and South America, Africa, and Europe.
Specialization: 2, 3, 4, 8, 11, 13, 15, 16, 17, 20, 21. Also special investigations of tannins and exudents, and valuations for tax and estate cases and civil claims.

Norman H. Gray, Forester, Lovell, Oxford County, Maine, R.F.D. 1.
Territory: Maine, New Hampshire.
Specialization: 3, 4, 13, 15, 16, 17, 18.

T. F. Grayson and Company, Commercial Foresters, P. O. Box 110, McRae Building, Prescott, Arkansas.
Territory: Southeastern United States.
Specialization: 2, 4, 8, 10, 11, 13, 15, 16, 17, 18. Also timber sales purchase management. Mill site locations.

Clarence W. Griffith (representing the James D. Lacey Company, 23 South La Salle Street, Chicago, Illinois, and Tensas Delta Land Company, 1001 Ouachita Bank Building, Monroe, Louisiana).
Territory: United States and Central America.
Specialization: 4, 15, 16, 17. Also purchase and sale of timbered properties.

Grogan, Donaldson, and Tulloch, Consulting Foresters, 1121 Rust Building, Tacoma 2, Washington.
Territory: Pacific Coast states.
Specialization: 4, 6, 10, 15, 16, 17, 18.

E. C. Haff, Forester, 836 Edisto Avenue, N. W., Orangeburg, S. C.
Territory: Southern and Appalachian types.
Specialization: 2, 3, 4, 10, 13, 15, 16, 17, 18. Studies of forest conditions from aerial photographs; management of timber properties for investors.

William H. Haley, Consulting Forester, P. O. Box 343, Hazelhurst, Georgia.
Territory: South Georgia, North Florida; southern pine and southern hardwood.
Specialization: 12, 13, 15, 16, 17.

Giles G. Hall, Forest Consultant, P. O. Box 1, 1212 Laurens Street, Aiken, South Carolina.
Territory: South Carolina and Georgia.
Specialization: 2, 3, 4, 5, 6, 7, 10, 13, 16, 17, 18. Also tree pruning in planted stands.

Hammon, Jensen and Wallen; Mapping and Forestry Services, 1492 Wilshire Blvd., Oakland, Calif.
Territory: Principally California, Nevada, and the Southwest, but also elsewhere.

Specialization: 2, 3, 4, 6, 8, 10, 11, 13, 15, 16, 17, 18. Both planimetric and topographic mapping, land net delineation, general land classification for appraisal purposes and ranchland management, and aerial photogrammetric consulting service. Emphasis on aerial photo techniques in all activities.

David H. Hanaburgh, Consulting Forester, Buchanan, New York.
Territory: Northeast.
Specialization: 2, 3, 4, 9, 10, 11, 13, 16, 17. Also negotiation of rights for hunting, fishing, trapping, and water storage.

A. D. Harvey and Associates, Consulting Engineers, Goldy Building, Medford, Oregon.
Territory: Oregon, Washington, and Northern California.
Specialization: 2, 3, 4, 5, 10, 13, 15, 16, 17, 18. Also mill and industrial building design.

Ralph C. Hawley, Consulting Forester, R. D. 1, West Cheshire, Connecticut.
Territory: Northeast.
Specialization: 4, 6, 16, 18.

K. J. Helmick, Consulting Forester, Fort Collins, Colorado.
Territory: Colorado, Wyoming, South Dakota, Utah, and New Mexico.
Specialization: 4, 10, 15, 16, 17.

Hiram L. Henderson, Manufacturer of Dry Kilns, 119 Stone Ridge Drive, Syracuse, New York.
Territory: Principally eastern states.
Specialization: 20. Also construction of lumber dry kilns.

Merton Henry, Forester-Aborist, Box 74, Bevans, New Jersey.
Territory: New Jersey, New York, and Pennsylvania.
Specialization: 1, 4, 5, 7, 15, 16, 17, 18.

Hamilton D. Hill, Consulting Forester, Glacier Creek Ranch, Seeley Lake, Montana.
Territory: Anywhere.
Specialization: 4, 15, 16, 17, 18. Also detailed topographic surveying and mapping preliminary to irrigation.

Monterey L. Holst, Consulting Forester, P. O. Box 125, East Greenwich, Rhode Island.
Territory: New England.
Specialization: 3, 4, 6, 9, 10, 13, 15, 16, 17, 18, 21.

Richard F. Howard, 15 Cherry Street, Franklinville, New York.
Territory: Pennsylvania and New York.
Specialization: 3, 4, 6, 15, 16, 17.

Gustaf W. Hult, Consulting Forester, 3029 Johnson Street, Corvallis, Oregon.
Territory: Oregon, northern California; Douglas-fir and pine.
Specialization: 16, 17. Licensed real estate broker in Oregon.

George D. Hunter, Consulting Forester, P. O. Box 244, Latham, New York.
Territory: New York and New England.
Specialization: 1. Also landscape design.

LeRoy W. Huntington, Consulting Tropical Forester, 52 Wesley Street, Baldwin, New York.
Territory: Latin America, Orient, Africa.
Specialization: 2, 3, 4, 10, 11, 15, 16, 17, 18; and tropical hardwoods.

R. Wilson Hutchison, Consulting Forester and Logging Engineer, 720 Harlow Road, Eugene, Oregon.
Territory: Washington, Oregon, and California.
Specialization: 2, 3, 4, 6, 10, 15, 16, 17. Registered professional engineer of the State of Oregon.

Gorham E. Jackson, Consulting Forester, 1035 Respass Street, Washington, North Carolina.
Territory: Eastern North Carolina and southeast Virginia. All forest types.
Specialization: 2, 4, 6, 9, 10, 13, 15, 16, 17, 18. Also investigations of forest resources for pulp and paper companies, and land agent for absentee timberland owners.

M. E. Jelley, Consulting Forester, 122 Haywood Avenue, Chattanooga 5, Tennessee.
Territory: Southeastern and eastern states.
Specialization: 2, 3, 4, 6, 8, 10, 11, 13, 15, 16, 17.

E. V. Jotter, Consulting Forester, Box 51, Cambridge, Ohio.
Territory: Ohio.
Specialization: 3, 4, 6, 9, 11, 16, 17, 18. Also development and management of community forests. Conservation education, cooperation with soil conservation districts.

Stuart G. Keedwell, Consulting Forester, Emporia, Virginia.
Territory: Virginia.
Specialization: 4, 10, 11, 15, 16, 17. Also purchase and sale of land and timber; and forest litigation.

John F. Kellogg, Forester, Route 1, Winnifield, Louisiana.
Territory: North Louisiana; pine and hardwood.
Specialization: 3, 4, 5, 16, 17.

Henry S. Kernan, Consulting Forester, South Worcester, New York.
Territory: Central New York.
Specialization: 3, 4, 5, 6, 7, 9, 10, 13, 15, 16, 17, 18.

Eugene H. Kincaid, Consultant in Forestry, Kincaid's Mountain Nursery, Idyllwild, California.
Territory: California, Sierra Nevada pine-region.
Specialization: 3, 4, 5, 6, 7, 8, 11, 15, 16, 17, 18. Also land exchange valuation, erosion control, recreational planning.

Robert K. Knoth & Company, Foresters, Appraisers, Surveyors, 39 Broad Street, Charleston 3, South Carolina.
Territory: South and Southeast; also tropical hardwoods.
Specialization: 4, 6, 10, 11, 13, 15, 16, 17, 18. Also serves as land agent for absentee timberland owners.

Cornelius W. Kuhn, Consulting Forester, Machias, R.D., New York.
Territory: Western New York.
Specialization: 4, 9, 15, 16, 17.

Langdale Timber Company, P. O. Box 2, Valdosta, Georgia.
Territory: Georgia and north Florida; slash pine belt.
Specialization: 2, 3, 4, 6, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19. Custom sawing.

Wilfred H. Lauer, Jr., Consulting Forester, P. O. Box 329, Winona, Minnesota.
Territory: North Central States principally, also available anywhere in United States.
Specialization: 2, 3, 4, 8, 10, 11, 13, 15, 16, 17, 18, 20. Also tree selection and marking for cutting; log scaling and grading; marketing and products brokerage; economic consultation and surveys; private, industrial, and farm forestry; and community forestry.

Frank J. Leimeux, Consulting Forester, 734 Whitney Bldg., New Orleans, Louisiana.
Territory: Southern states, Mexico, Central and South America.
Specialization: 2, 4, 6, 13, 15, 16, 17.

Paul C. Lemon, Consulting Forester, State College, Albany 3, New York.
Territory: New York.
Specialization: 1, 6, 9, 14. Also commercial pilot, applications of aviation to forestry.

T. A. Liefeld, Consulting Forester, Thomasville, Georgia.
Territory: Florida, Georgia, Alabama.
Specialization: 2, 3, 4, 5, 6, 7, 8, 11, 12, 13, 15, 16, 17, 18.

L. D. Lloyd & Company, (L. D. Lloyd, W. B. Gansberg, Lief Highland, associates), 14 Long-Bell Building, Longview, Washington.
Territory: Fir and pine regions of Washington and Oregon.
Specialization. 2, 3, 4, 5, 6, 10, 13, 15, 16, 17.

Gordon W. Ludwig, Agricultural Engineer, Ludwig Brothers Engineers, 608 S. Fair Oaks Avenue, Pasadena 2, California.
Territory: California.
Specialization: 2, 4, 6, 7, 15, 16, 17 and 18. Also specialist in soils and soil science; nursery practice and special water treatment processes for conditioning water to meet special nursery requirements. Associated with registered civil engineers specializing in sanitary engineering; specialists on problems of sewage disposal and reclamation for irrigation, special designs for recreational resorts, and underground leaching problems.

Roy W. Lundh, Consulting Forester, Dawson, Nebraska.
Territory: Missouri, Iowa, Nebraska, Kansas.
Specialization: 2, 3, 4, 10, 15, 16, 17.

Donald K. Maissurow, Consulting Forester, New Haven Avenue, Derby, Connecticut.
Territory: New England states.
Specialization: 1, 4, 5, 7, 15, 16, 17, 18. Also landscape forestry.

Mason, Bruce & Girard, Consulting Foresters. Consultants: David T. Mason, Donald Bruce, James W. Girard, R. S. Kearns, Karl D. Henze, Ralph D. Marlatt, Gene D. Knudson, Gilbert M. Bowe, Roy C. Elmgren. American Bank Building, Portland 5, Oregon.

Earl M. McChesney, Forester, Tree Surgeon, Personnel Worker, 4 New York Street, Bangor, Maine.
Territory: Maine, New York.
Specialization: 1, 4, 5, 7, 10, 15, 17, 18. Also personnel management work in forest enterprises.

Fred B. Merrill, (with Givens and Merrill), Consulting Forester, P. O. Box 302, Slidell, Louisiana.
Territory: Mississippi and Louisiana within 75 miles of Slidell.
Specialization: 4, 5, 6, 7, 11, 16, 17. Training estate and company personnel; buying and selling timberlands.

William J. Mills, Forest Engineer, 530 Volunteer Building, Chattanooga 2, Tennessee.
Territory: Southeastern states, all forest types; Mexico, oak.
Specialization: 3, 4, 11, 13, 15, 16, 17.

Malcome A. Milne, Consulting Forester and Landscape Engineer, 433 Clay Ave., Rochester, New York.
Territory: Central and western New York.
Specialization: 1, 5, 7, 18. Also landscaping, estate development and management, and forest recreation.

R. B. Milne, Consulting Forester, Box 371, Petersburg, Virginia.
Territory: Southeastern states; all forest types.
Specialization: 3, 4, 10, 16, 17.

George S. Milnes, Consulting Forester, 120 South Carolina Street, Saginaw 60, Michigan.
Territory: Michigan.
Specialization: 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 15, 16, 17, 18. Also manufacture and marketing of forest products, and cropping of forest lands, management of community forests and forest investment property. Training and safety programs in woods operations.

Stuart Moir, Forest Counsel, Western Forestry & Conservation Association. 712 U. S. National Bank Building, Portland 4, Oregon.
Territory: Northwest.

William Mollenhauer, Jr., Landuse Consultant, 186 West Avenue, Pitman, New Jersey.
Territory: New Jersey.
Specialization: 4. Also flood and erosion control; ecological surveys of plant and animal relations in forest and rural areas; organizing and development of farm and forest cooperatives; and economic and social surveys of forest and rural areas, including labor relations, activities, trends, and developments.

Robert Moore, Consulting Forester, Danville, Pennsylvania.
Territory: Not restricted.
Specialization: 2, 3, 4, 6, 8, 10, 11, 13, 15, 16, 17, 18, 19. Also bankruptcy cases, trade association work, coal lands, trusteeship cases, litigation and damage claims; estate problems.

Kenneth J. Morgan, Consulting Forester, Stephen F. Austin State Teachers College, Nacogdoches, Texas.
Territory: Texas and the East.
Specialization: 1, 3, 4, 15, 16, 17, 18. Also farm forestry, erosion control, and general protection.

Lee H. Morrow, Consulting Forester, 140 North Atherton Street, State College, Pennsylvania.
Territory: Pennsylvania.
Specialization: 1, 2, 3, 4, 5, 6, 7, 10, 11, 13, 15, 16, 17, 18. Also erosion control of large embankments by engineering structures and vegetative treatment. Property maps and forest type maps from aerial photographs.

John L. Myers, The Empire State Tree Expert Company, 606 South Crouse Avenue, Syracuse 10, New York.
Territory: New York State.
Specialization: 1, 7, 8.

Leon A. Nix, Consulting Forester and Logging Expert, Room 1312-A, 67 Yonge Street, Toronto, Ontario, Canada.
Territory: Not limited.
Specialization: 2, 3, 4, 6, 10, 13, 15, 16, 17. Also farm woodlot management.

Northwest Timber Company, Consulting Foresters, Drawer 740, Kalispell, Montana.
Territory: Western and central Montana and north Idaho.
Specialization: 2, 4, 10, 11, 15, 16, 17.

Northwest Timber Service, Consulting Foresters, P. O. Box 478, Chehalis, Washington.
Territory: Pacific Northwest.
Specialization: 2, 3, 4, 6, 13, 15, 16, 17, 18.

W. R. Owens, Jr., Consulting Forester, 2026 North Street, Nacogdoches, Texas.
Territory: East Texas, Louisiana, the South in general.
Specialization: 3, 4, 5, 6, 7, 10, 11, 12, 13, 15, 16, 17, 18.

Gustave C. Piche, Consulting Forest Engineer, 3667 St. Hubert Street, Montreal, Canada.
Territory: Eastern Canada, particularly the Province of Quebec.
Specialization: 2, 3, 4, 13, 15, 16, 17, 18, 21. Also farm forestry.

Pond & Moyer Inc., Co., Consulting Foresters, 107 Homstead Road, Ithaca, New York.

Territory: New York and Northeast, Latin America; Northern hardwoods, spruce-fir, central hardwoods, tropical woods.
Specialization: 2, 3, 4, 8, 10, 11, 13, 15, 16, 17, 18, 21.

Prentiss & Carlile Company, Inc., Timberland Service—Engineers, Merrill Trust Building. 12 Hammond Street, Bangor, Maine.
Territory: United States and Canada.
Specialization: 2, 3, 4, 8, 10, 11, 13, 15, 16, 17, 18.

John G. Rawls Co., Consulting Foresters, 408 Rogers Avenue, Macon, Georgia.
Territory: Southeast.
Specialization: 10, 12, 13, 15, 16, 17.

Arthur D. Read, Consulting Forester, Box 133, Monroe, Louisiana.
Territory: Southern pine region.
Specialization: 4, 15, 16, 17, 18. Emphasizing seed collection, establishment of pine tree nurseries and outplanting.

Richard C. Rose and C. T. Brown, Sable Mountain Corporation, Stockbridge, Vermont.
Territory: New England, also forest aerial photography in the South.
Specialization: 2, 3, 4, 15, 16, 17. Mapping and cruising by aerial techniques, contract logging, and marketing.

A. P. Russell, Commercial Forester, 11 Maplewood Drive, Sumter, South Carolina.
Territory: Southern states. All forest types, specializing in southern hardwoods.
Specialization: 2, 3, 4, 10, 13, 15, 16, 17, 18.

C. D. Schultz and Co., Ltd., Foresters, Forest Engineers and Timber Counsels, B-102 Pacific Coast Fire Building, 325 Howe Street, Vancouver, British Columbia, Canada.
Territory: British Columbia.
Specialization: 2, 3, 4, 6, 10, 11, 15, 16, 17, 18, 20. Also supervision of contract logging; timberland sales; aerial photographic surveys and aerial topographic mapping and fire hazard appraisals.

Thomas F. Schweigert, Consulting Forester, Wallon Lake, Michigan.
Territory: Northern half of Lower Peninsula and eastern half of Upper Peninsula, Michigan.
Specialization: 1, 4, 6, 15, 16, 17, 18.

H. C. Scott, Aboriculturist and Landscape Engineer. Lookout Mountain, Tennessee.
Territory: Eastern states.
Specialization: 1. Also landscape construction and woodland improvement.

Harold M. Sebring, Consulting Forester and Sawmill Operator, McRae, Georgia.
Territory: Southeastern states; all forest types.
Specialization: 3, 4, 6, 10, 15, 16, 17.

Alexander L. Setser, Consulting Forester and Operator of Jackson Lumber Harvesters, East Tennessee Timber Service, Inc., Box 23, Norris, Tennessee.
Territory: Southeastern states, including Appalachian and southern hardwood and southern pine regions.
Specialization: 2, 3, 4, 6, 9, 11, 13, 16, 17, 18. Also production of rough lumber, crossties, mine timbers, pulpwood, and fence posts.

Simmons and Stuart, Consulting Foresters, Bel Air, Maryland, or Burgess Store, Virginia.
Territory: Eastern states.
Specialization: 2, 3, 4, 10, 11, 13, 14, 15, 16, 17, 18. Also investigation and arbitration of claims; and operational management in the manufacture and marketing of forest products.

Seymour I. Somberg and Harold R. Lesselbaum, Forestry Aids, Lane, South Carolina.
Territory: Southeastern United States.
Specialization: 2, 3, 4, 8, 10, 11, 13, 15, 16, 17, 20. Acquisition and management for investors. Forest resource surveys for industry.

Frank Spearey, Land Surveyor, Timber Estimator, and Consulting Forester, P. O. Box 547, Nacogdoches, Texas.
Territory: Gulf states.
Specialization: 4, 15, 16, 17. Also timber marking and marketing.

Stephen H. Spurr, Consulting Forester, Harvard Forest, Petersham, Massachusetts.
Territory: East and South.
Specialization: 4, 15, 17. Also forest aerial photography.

Everett R. Stanford, Consulting Forester, 409 North Atlantic Boulevard, Alhambra, California; California Termite Control Company, Inc., 915 North Western Avenue, Los Angeles 27, California.
Territory: Southern California. Chaparral mountain watersheds; recreational pine, fir, and cedar forests; related communities.
Specialization: 1, 5, 6, 7, 11, 18. Also forest watershed management; land-use control; erosion control; mountain forest home,

camp, and forest park planning and management. Structural pest control.

T. J. Starker and Son, Route 1 (3760 Harrison St.), Corvallis, Oregon.
Territory: Oregon and Washington.
Specialization: 1, 3, 4, 10, 16, 19, 21.

E. A. Sterling, (representing The James D. Lacy Company, 231 South La Salle Street, Chicago), 39 Lake Ave., Montrose, Pennsylvania.
Territory: No regional limits, but active mainly in the South; also Central America and Mexico.
Specialization: 3, 4, 6, 13, 15, 16, 17, 18, 19.

Charles H. Stoddard, Consulting and Operating Forester, 419 Lyceum Building, Duluth, Minnesota; Field Office, Minong, Wisconsin.
Territory: Northern Lake states.
Specialization: 2, 4, 5, 6, 7, 8, 9, 13, 15, 16, 17, 18. Also public forest problems, produce special forest products, forest resource surveys for industry.

Errol Tarbox, Consulting Forester, 1 Carver Street, Sanford, Maine.
Territory: Southern Maine and New Hampshire.
Specialization: 4, 16, 17.

Vern H. Thaler, Consulting Farm Forester, 15486 Monica Avenue, Detroit 21, Michigan.
Territory: Southern Michigan, northern Indiana, and Ohio.
Specialization: 4, 5, 6, 7, 9, 15, 16, 17, 18.

Tidewater Land and Timber Service, Timber Appraisals, Route 1, Box 115A, Williamsburg, Virginia.
Territory: Virginia, North Carolina, and other southern states; pine and bottomland hardwood types.
Specialization: 16, 17.

John F. Tillinghast, Consulting Forester, Mount Hope, West Virginia.
Territory: West Virginia, eastern Kentucky, and western Virginia.
Specialization: 3, 4, 6, 15, 17, 18.

Henry H. Tryon, Consulting Forester, 528 Mountain Road, Cornwall-on-Hudson, New York.
Territory: New York and New England.
Specialization: 3, 4, 10, 15, 17, 18. Also specializing in sprout hardwood region.

Vitas and Schavilje, Consulting Foresters, 4401 Montrose Blvd., Houston 6, Texas.
Territory: Texas, Louisiana, and Arkansas.
Specialization: 3, 4, 8, 11, 12, 13, 15, 16, 17, 18.

Myron S. Wall, Jr., Consulting Forester, Jackson, California.
Territory: California.
Specialization: 4, 6, 10, 15, 16, 17.

Waverly Timber Company, Inc., Consulting Foresters, Waverly, Tennessee.
Territory: Tennessee, southern Kentucky, the northern sections of Georgia, Alabama, and Mississippi.
Specialization: 4, 6, 8, 16, 17.

Edward H. Werner, Consulting Forest Engineer, 1506 Broadway, Sacramento, California.
Territory: Northern California (except coastal area).
Specialization: 3, 4, 10, 16. Also timber and log procurement, timber sale and logging contract specifications, state forest practice act regulations, scaling service, and timber trespass and timber land damage claim valuation.

J. Atwood Whitman, Consulting Forester, Glendon, North Carolina.
Territory: Southern states.
Specialization: 4, 15, 16, 17, 18. Also forest damage appraisal, growth analysis, timber type maps, and municipal forestry.

S. A. Wilde, Soils Department, University of Wisconsin, Madison 6, Wisconsin.
Territory: Wisconsin, Minnesota, Michigan, Missouri, Illinois, Indiana, Ohio.
Specialization: 18. Including survey of forest tracts, selection of planning sites, management of forest nursery soils.

Ellwood Wilson, Consulting Forester, Box 43, Knowlton, Quebec, Canada.
Territory: Ontario, Quebec, New Brunswick, Nova Scotia, eastern United States.
Specialization: 2, 4, 13, 16, 18.

Richard E. Wilson, 126 Kelvin Place, Ithaca, New York.
Territory: Not restricted.
Specialization: 18. Establishment and care of plantations.

Kendall B. Wood, associates Richard C. Grant, Spencer B. Gross, Arthur E. Sherman, Jr., Consulting Forest Engineers, 108 Salmon Street Terminal Building, Portland, 4, Oregon.
Territory: Pacific Northwest.
Specialization: 2, 10, 16, 17.

K. W. Woodward, Consulting Forester, Durham, New Hampshire.
Territory: Northeast, Southeast, and Tropics.
Specialization: 1, 4, 9, 15, 16.

Forestry News

Compiled by ROBERT D. HOSTETTER, *Assistant Executive Secretary*

JOHN G. GUTHRIE, forestry agent for the Illinois Central Railroad in Mississippi, is shown above demonstrating a new type of tree planting machine. Developed by Professor Daniel DenUyl of the Purdue University Forestry School, it is based on the frame of an ordinary farm breaking plow. The machine, which can plant trees about ten times as fast as can be done by hand, is being used on various farms and school lands from Jackson to Gulfport.

APA Engages Forest Engineer

W. S. Bromley, of Ironwood, Michigan, has been appointed forest engineer for the American Pulpwood Association. He will be in charge of the Association's mechanization program which was inaugurated in 1944.

Mr. Bromley graduated from Pennsylvania State College in 1931 and seven years later was awarded the M.F. degree by Yale University.

He has had experience as a C.C.C. camp superintendent in Ohio; with the U. S. Forest Service in the Lake States; on the faculty of the forestry school at the University of Michigan; operating his own pulpwood operation; and doing consulting forestry work.

Lookout Tower Houses Crew

A modified form of lookout tower that combines lookout, garage, and living quarters for a six-man maintenance and fire suppression crew is planned for Green Mountain in Oregon. The three-story unit is 14 feet square.

Chapman and Wyckoff Attend Pacific Science Congress

H. H. Chapman, professor emeritus at the Yale School of Forestry, and Stephen N. Wyckoff, U. S. Forest Service, Berkeley, Calif., were foresters from the United States who attended the Pacific Science Congress at Auckland and Christchurch, New Zealand during February, 1949. Over seventy American scientists attended.

Object of the Congress, seventh to be held, is to provide an opportunity for research men to have deliberate discussions every three to five years of scientific problems relating to the Pacific region.

Tree Planting Demonstrated

In an effort to obtain the highest survival possible of the 30 million pine seedlings being distributed in South Carolina this winter by the State Commission of Forestry, 67 planting demonstrations were conducted in South Carolina's 46 counties, according to W. J. Barker, forester of the Clemson College Extension Service.

Forestry Program Emphasizes Cooperation of Valley People

The 1948 annual report of the T.V.A. Division of Forestry Relations in listing cooperative accomplishments with state forestry, fish, and game divisions; state agricultural extension services and experiment stations; several federal agencies; and many citizen organizations emphasizes that the Tennessee Valley forestry program deals with people as well as trees.

"The average man must be equipped mentally, physically, and financially to do the job," states the report. "His performance is the key to conservation just as it is the basic principle of democratic government."

Forest management and farm woodland demonstrations designed to better acquaint average citizens with the principles of good forestry were a major part of T.V.A. forestry work. Cooperative fire control projects, fence post preservation demonstrations, forest utilization studies, fish and wildlife development, and other projects were conducted by the Division of Forestry Relations during fiscal year 1948.

Simmons Gives Logging Advice

Emphasizing the desirability from a cost standpoint of selecting the logging machinery and methods of logging best adapted to the particular situation under consideration, Fred C. Simmons, logging specialist at the Northeastern Forest Experiment Station, has written the first of a series of papers about the supervisory part of the logging job.

Issued as Station Paper No. 18 and called Choosing Methods and Equipment For Logging, it will be followed by publications dealing with job layout, recruiting and training of workers, purchase of timber, and marketing timber products.

Forestry Legislation

Forest

H. R. 865 (By McDonough of California), H. R. 1355 (By Engle of California), and S. 149 (By Cordon of Oregon) are bills providing for the annual payment by the United States to States, for distribution to counties, of sums equal to two per centum of the fair value of the national-forest lands situated in the counties as determined by the Secretary of Agriculture. Referred to appropriate committees.

H. R. 1969 (By Sikes of Florida) is a bill to encourage better management of privately owned forest lands and to increase the efficient production, processing, marketing, and utilization of forest products through making available technical services and assistance to forest owners, operators of wood-using industries, and consumers of forest products, and for other purposes. Referred to Committee on Agriculture on January 27.

Range

S. 31 (By McCarran of Nevada) is a bill to amend the Taylor Grazing Act for the purpose of providing for greater participation by district advisory boards in administration of the act. Referred to Committee on Interior and Insular Affairs on January 5.

Wildlife and Recreation

H. R. 892 (By Peterson of Florida) authorizes the establishment of a Federal Interagency Committee on Recreation. Referred to Committee on Public Lands on January 5.

H. R. 1746 (By Dingell of Michigan) provides that the United States shall aid the States in fish restoration and management projects. Referred to Committee on Merchant Marine and Fisheries on January 24.

S. 340 (By Thomas of Oklahoma) is a bill to facilitate the administration by the Secretary of Interior, in cooperation with other Federal agencies, of the recreational uses of lands and waters within reclamation, flood control, power, and other Federal reservoir projects. Referred to Committee on Interior and Insular Affairs on January 13.

Water and Soil

H. R. 463 (By Keogh of New York) is a bill to establish a Merrimack Valley Authority. Referred to Committee on Public Works on January 5.

H. R. 894 (By Rankin of Mississippi) provides for the creation of conservation authorities to develop, integrate and coordinate plans, projects and activities for or incidental to the promotion of navigation, the control and prevention of floods, the safeguarding of navigable waters, the reclamation of the public lands, and the generation, sale, and distribution of electric energy. Valley authorities are provided for each of the great river systems of the country. Referred to the House Committee on Public Works on January 5.

S. 33 (By McCarran of Nevada) is a bill to establish a National Water Conservation Authority and for other purposes.

S. 64 (By Maybank of South Carolina) is a bill to establish a Savannah Valley Authority. Referred to Committee on Public Works on January 5.

S. 142 (By Cordon of Oregon) authorizes the construction of a multipurpose reservoir on the Pend Oreille River in Idaho. Referred to Committee on Public Works on January 5.

Products

Thirty senators and representatives have introduced or identified themselves with bills identical or similar to H. R. 11 and 94 (mentioned last month) to establish a national housing objective.

Jurisdiction

H. R. 849 (By Clifford R. Hope of Kansas) is a bill about which conservationists will hear considerable during the 81st Congress. It is similar to the Hope Bill, H. R. 6054, of the last Congress but is more comprehensive and changes somewhat the plan as laid out in the previous bill. Known as the National Land Policy Act, it provides that the Secretary of Agriculture shall set up within the Department of Agriculture an Agricultural Resources Administration with an administrator appointed by the Secretary. To this Administration would be transferred all agencies, functions, powers, and duties(including personnel and equipment) that perform activities relating to the conservation, improvement, and development of agricultural land and water resources (defined to include forest land and wildlife habitats). Conservation policies established in the bill would be administered within the Agricultural Resources Administration by its three constituent agencies, an Agricultural Land Service, a Forest Service, and a Fish and Wildlife Service. Present agencies to be consolidated in the Administration include the Forest Service; the Soil Conservation Service; the related functions of the Production and Marketing Administration; functions of the Farmers Home Administration related to water conservation in arid areas; soil survey and research functions in water and soil physics now exercised by the Bureau of Plant Industry, Soils, and Agricultural Engineering; the Bureau of Land Management except functions relating to mines and public land ownership; agricultural activities of the Bureau of Reclamation; the Fish and Wildlife Service; and all related activities of all other federal agencies except T.V.A., National Park Service, and Office of Indian Affairs. The bill also provides for a survey and classification of land use capabilities for cultivation, production of forests and forest products, production of range livestock, wildlife use, and potentially suitable for agricultural use through irrigation, drainage, clearing, or otherwise. In addition, the bill provides for assistance and payments to promote conservation. It was referred to the Committee on Agriculture on January 5.

Similar consolidation plans will be recommended in the report to Congress by the Hoover Commission. The Commission favors con-

solidation of conservation agencies into one "Agricultural Resources Conservation Service." It also recommends that all research work be done by a consolidated "Research Service" divided into appropriate bureaus—crops, forest and range, animals, structures and machines, soil and water, human nutrition and home economics, marketing utilization, and agricultural economics. One or two additional levels of authority would be placed between bureau chiefs and the Secretary.

H. R. 1230 (By King of California) provides for the establishment of a national natural resources policy, creation of a Natural Resources Council, and provides for a natural resources inventory. Referred to Committee on Public Lands on January 10.

S. 35 (By McCarran of Nevada) is the same as H.R. 1230.

S. Con. Res. 5 (By Cain of Washington) establishes a joint Congressional committee of four senators and four representatives to conduct a study of lands within Olympic National Park to determine a sound program for the conservation of natural resources, to consider transfer of Park lands to administration by the Forest Service, and to establish a permanent boundary line for the Park. Referred to Committee on Interior and Insular Affairs on January 10.

S. 148 (By Guy Cordon of Oregon) is identical to S. 580 of the 80th Congress, which passed in the Senate, but not the House. It provides that the so-called "controverted" lands totaling approximately 460,000 acres on the periphery of the Oregon and California Railroad grant lands in western Oregon which have been administered for some years by the U. S. Forest Service will be placed under the jurisdiction of the Bureau of Land Management. Federal remuneration to counties in which the land is situated would thereby probably be increased. It also provides for the exchange of property by the two federal agencies to permit greater ease of administration than now possible because of intermingled holdings. Referred to Committee on Interior and Insular Affairs on January 5.

S. 526 (By McClellan of Arkansas) authorizes the President to submit government agency reorganization plans for action by Congress. Referred to Committee on Expenditures in the Executive Departments on January 17.

Development

S. J. Res. 24 (By Morse of Oregon) provides for a suitable and adequate system of timber access roads to and in the forests of the United States, and authorizes $30,000,000 annually ($25,000,000 for the Secretary of Agriculture and $5,000,000 for the Secretary of Interior).

Miscellaneous

S. 247, H. R. 12, H. R. 311, and H. R. 359 all provide for the establishment of the National Science Foundation.

Budget

The President's Budget for the 1949-50 fiscal year is under consideration by the House Committee on Appropriations.

Recommendations for appropriations for the National Park Service are $29,495,181, considerably more than twice the 13 million appropriated last year.

Bureau of Land Management recommendations are about the same as last year, while those for the Bureau of Reclamation are up 27 million.

The Forest Service suffered a cut of nearly $12,000,000 in the Budget recommendations, but most of that amount is accounted for in the transfer of a considerable sum to the Public Roads Administration. Land acquisition was cut $99,000, but $100,000 were recommended for acquisition of land in the roadless area of the Superior National Forest.

Soil Conservation Service recommendations are for $3,750,000 more than appropriated last year.

Recommendations for the Fish and Wildlife Service are essentially the same as last year's appropriations except for some in-service shuffling.

Survey Covers 59 Percent of Nation's Timber Acreage

Surveys of the timber resources on 63,000,000 acres of forest land in 12 states and the re-inventory of an additional 48,000,000 forest acres in eight other states have been completed within the past two years, the Forest Service has announced. Preparation of the survey data for publication by states and counties is now in progress and will be made available to states, industries, and interested communities as soon as possible.

The 63,000,000 acres of forest land surveyed for the first time during the last two years brings to 365,000,000 acres or 59 percent the total so inventoried since the project to survey the nation's timber resources was begun in 1930, leaving 259,000,000 acres still to be covered. Provision for periodic re-inventory of the timber resource on land already surveyed, with a view to keeping the reports up to date, was made by Congress in 1944 and up to now 48,000,000 acres have been gone over for the second time. Cutting operations, forest fires, attacks of insects and disease and changes due to growth are principal factors in making it necessary to recheck these areas if the survey figures are to be kept current.

The surveys were made for areas where reliable information as to forest areas, timber volumes, rates of growth and depletion, ownership, and demand for forest products are vitally needed as a guide to sound programs for industrial development, taxation, fire prevention, and land management.

Initial surveys were conducted during the past two years in these 12 states: Arkansas, California, Illinois, Kentucky, Missouri, Montana, New Hampshire, Maine, New York, Pennsylvania, Vermont, and West Virginia. The eight states where re-survey jobs were done are Idaho, Michigan, Minnesota, Mississippi, Oregon, South Carolina, Washington, and Wisconsin.

South Dakota Tabulates Timber

A summary of available information relative to the timber resources of South Dakota has recently been prepared by Irving H. Moore, assistant state forester.

The volume of the ponderosa pine type which covers 1,368,536 acres in the western part of the state is estimated at nearly three billion board feet. That is nearly twice the volume of the mixed hardwood type. Missouri river cottonwood, cedar, and Black Hills spruce are other distinct types.

Forest ownership, growth, drain, uses, and value as well as a directory of sawmills and timber producers are also listed.

Australian Ecologist Visits United States Scientists

Dr. Robert L. Crocker, grassland ecologist of Waite Agricultural Institute, University of Adelaide, South Australia, is visiting and conferring with range and forest ecologists, pedologists, and geologists of the United States, following a year and a half's study in England.

Dr. Crocker has been working with various schools and experiment stations throughout the country and studying recent research developments in range management, artificial revegetation, and soil science which can be applied in Australia. He has visited the New York Botanical Garden and the Universities of Michigan, Minnesota, Nebraska, Nevada, and California, agricultural colleges of New Mexico and Utah, and the Southwestern, Intermountain, and California Forest and Range Experiment Stations.

Dr. Crocker is returning to Australia March 15, after about six months' stay in this country.

Deer Sets New Speed Record

Near Hinton, West Virginia, an adult Virginia white-tailed deer, a doe, was clocked at forty miles per hour by a C&O railroad engineer.

The deer ran directly beside the engine cab for almost a mile, confined to the right-of-way by a wire fence. The speedometer on the engine recorded forty miles per hour, probably a newly established speed record for white-tail deer.

Hurtling one gate that had swung open toward the tracks, the doe sped through a second open gate and into a broomsedge field.

Schweigert Publishes Folder

A folder titled "Cash Crops from Woodlands" has been issued by Thomas F. Schweigert, consulting forester of Walloon Lake, Mich.

Written in simple language, it is designed to better acquaint woodland owners with the potentialities of their timber and to provide them with basic forestry information.

GEORGE A. GARRATT, above, is president of the Forest Products Research Society, organized two years ago to promote more efficient use of wood and other forest products.

Membership presently includes 1,581 voting and associate members, 142 student members, and 127 supporting members.

Interchange of forest products research information is a primary objective which seeks to lessen duplication of activities.

FPRS Proceedings Available

The Forest Products Research Society has announced the release of the proceedings of the second national meeting of the Society, which was held on March 22-24, 1948, at the American Furniture Mart, Chicago, Ill.

Contents of the book include the following general subjects: improved utilization of wood and chemical conversion of wood waste; mechanical conversion of wood waste and manufacture of fiber products; bark removal and utilization; coordination of research in the field of forest products; finishes for furniture; woodworking equipment; dielectric heating; and miscellaneous other subjects.

A limited number of copies of this book are available and may be purchased at $8 per copy by placing an order with Charles E. Van Hagan, secretary-treasurer, Forest Products Research Society, Box 2010 University Station, Madison 5, Wis.

Mississippi Forester Lauds Aerial Detection of Fires

C. H. Lewis, Jr., forester-pilot for the Crosby Lumber and Manufacturing Company, Crosby, Miss., reports that airplane detection of forest fires has proven so effective that his company has abandoned fire towers built in 1939 to afford coverage of 137,000 acres of forest land.

Citing the cost of four, radio-equipped lookout towers as $14,400 as compared with an initial investment of $2,800 for a radio-equipped airplane capable of detecting fires in one county, Mr. Lewis adds that gas, oil, maintenance, and pilot expenses during a fire season amount to only 45 percent of towermen's wages for the same period.

He emphasizes that airplane patrol enables greater accuracy in locating fires and reduces to zero the number of false alarms, which under the fire tower system of detection had occupied 35 percent of the time of the control crew.

"Another highly desirable feature of airplane detection," says Lewis, "is the fact that the routine jobs of planting, timber marking, timber deadening, fire line plowing, etc., can be carried on during the worst fire season. Not until the airplane begins to circle about the crew is it necessary for the crew leader to snap on his radio set for his instructions, at which time the men and machinery are dispatched to the fire."

Children's Tree Book Issued

T. E. Shaw, forestry professor, and J. L. VanCamp, extension forester, both of Purdue University, have recently had published a 62-page booklet titled "Fifty Common Trees of Indiana."

With the leaves, fruit, and twigs of important Indiana trees pictured, descriptions are written in non-technical terms so that the 13-year olds who compose the median age group of 4-H clubs, boys and girl scouts, and other children's organizations will be able to identify the common trees that they see.

Picture Stories Published

Two recently issued publications, profusely illustrated with apt photographs that complement prose continuity, have attracted considerable reader interest.

One is a story in pictures and words of the history and development of lumber manufacturing in the Northeast. Titled "Serving the Nation's Greatest Lumber Consuming Market," it was published by the Northeastern Lumber Manufacturers Association, Inc., 271 Madison Avenue, New York 16, New York. All steps in the transforma tion of trees to finished products are illustrated.

The other publication was issued by the Indiana Coal Producers Association, Grand Opera Building, Terre Haute, Ind. Its title is "Man-Made Forests of Indiana, The Story of an Industrial Cycle." Illustrations are used to show the successive steps which have taken place in Indiana from unbroken forest land to agricultural clearings, to erosion, to open cut method of coal mining, to reforestation and the benefits to be derived from hills reclad with timber.

Pulp Report Analyzes Trends

Timely and useful information on conditions in all branches of the industry appear each month in the "Pulp and Paper Industry Report" issued by the Department of Commerce.

It covers the supply-demand position, production and distribution problems, import-export developments, and gives statistics of practical value. Each issue contains a section devoted to pulpwood. Highlight of every report is an impartial analysis of current and prospective trends.

The "Pulp and Paper Industry Report" is prepared monthly by the U. S. Department of Commerce and is available on an annual subscription basis of $2.25 from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Make check or money order payable to Treasurer of the United States.

Charges Made Experimentally For Recreational Facilities

An experimental plan to collect fees for the use of certain representative recreational areas within national forests will be inaugurated with the 1949 vacation season, according to a recent announcement by the U. S. Forest Service. Small charges will be made at some camp, picnic, and winter sports areas to determine whether recreational use of national forests should pay some part of its own way. Congress has made repeated suggestions that it should.

This will mark the first time, except in minor instances, that the Forest Service has departed from its traditional custom of providing free public recreation in the management of the national forests. Attention is called to the fact that proposed charges will be for the use of facilities and not for entrance to national forests. Many small, free camp and picnic areas will be maintained in addition to the ones where charges are made.

Cooperate to Show Thinnings

The United Agricultural Workers of York County, S. C., composed of all publicly employed agricultural workers, sponsored a forestry thinning field day near Tirzah on the farm of William T. Oates. Held on January 19, 150 persons attended.

Cooperating with the agriculturalists were extension foresters of the Clemson College Extension Service, State Commission of Forestry personnel, representatives of the International Paper Company and the Charlotte branch manager of the Chapman Chemical Company.

Thinnings for fuelwood, posts, and pulpwood were demonstrated, as well as the treating of fence posts with several preservatives.

Growth per acre per year on one 14-year-old pine plantation's area that was thinned amounted to 2.37 cords. A stand of 20 cords per acre was left standing. The pulpwood removed, when loaded on railroad cars, was worth $122.32 per acre.

Burning Increases Runoff

Most apparent results shown by a nine-year study at North Fork, Calif. of the effects of removing vegetation were increased surface runoff and erosion.

Surface runoff from annually burned plots in the woodland-chaparral type averaged about 14 percent, from twice-burned plots 2 percent, and from undisturbed plots less than 0.1 percent of the precipitation.

Annual erosion rate from annually burned plots was about 25,000 pounds per acre, from twice-burned plots 1,000 pounds, and from undisturbed plots 1.5 pounds.

On the annually burned plots the average infiltration capacity of the soil was reduced more than 95 percent during the first three or four years of burning.

Research on the "Influence of Woodland Chaparral on Water and Soil in Central California" was conducted cooperatively by the State of California and the California Forest and Range Experiment Station. P. B. Rowe is the author of the bulletin in which a detailed account of the experiment is given.

Students Operate Forest

A 40-acre school forest is being used as a field laboratory by students of Glen Barquest, agricultural instructor at the Athens, Wis., high school in Marathon county. By special arrangement with village officials the tract, which is located within the community's watershed forest, was made available to the students.

Freshmen will study how the forest lives and grows and will study tree and wood identification. Sophomores will set up inventory plots, carry on thinning experiments, make reproduction counts, and establish camera points. Juniors will make a cruise of the area, and seniors will prepare a management plan. Lumber cut from the forest will be used in the school workshop, the price to be charged being determined by students' cost analyses.

Right-of-Way Provides Cover

Thousands of miles of right-of-way for power and telephone lines, forming a network over America, could be developed into excellent wildlife habitat with mutual benefits to game, sportsmen, and the utility corporations, according to the Wildlife Management Institute. Utilities could retard the growth of undesirable brush and trees by sowing Lespedeza sericea and other species that choke out brush and form an excellent cover for quail, pheasants, rabbits, and other wildlife.

"Lonnie's New Crop" Describes Profitable Pine Production

An informational film on the subject of tree planting in the South has been completed under the sponsorship of the Southern Pulpwood Conservation Association and the Georgia Forestry Department, according to an announcement by H. J. Malsberger, forester of the association. The film was produced by the Southern Educational Film Production Service of Athens, Ga.

The running time of the film is about ten minutes. It is in color and with sound. The Southern Pulpwood Conservation Association, 1506 First National Bank Building, Atlanta 3, Ga., will sell the film for the cost of printing. A limited supply will also be available for loan.

It is one of a series of four films being produced on the subject of southern forestry.

High Stumps Logged in Oregon

Spruce stumps in Clatsop County, Oregon, which were originally cut one, two, and three springboards high are now being logged and manufactured into thin veneer which is used for cigar boxes.

Harold Turlay, manager of the Uptegrove lumber plant in Astoria which buys the stumps, says that his organization can use anything that is 4.5 feet in length and over. Some of the stumps furnish two or three blocks. Stumps of trees felled as long as eight years ago are still sufficiently sound to justify cutting.

Forest Industries Surveyed

"A Forest Industries Survey of Oklahoma" by Ed. R. Linn, associate forester, has been published as Experiment Station Bulletin No. B-325 by Oklahoma A and M College, Stillwater.

It includes a description of the extent, development, and importance of the forest industry in Oklahoma as well as a directory of wood-using industries and tables of sawmills by counties. An analysis of wood-using plants other than sawmills is also provided.

Foresters In The News

CHARLES E. GILL has been appointed associate extension forester in Virginia, with headquarters at Blacksburg.

REX S. HARPER, recent University of Georgia graduate, has been appointed information and education forester in the Florida Forest Service's Ocala office, replacing Robert K. Dodson who resigned to accept a position with the U. S. Forest Service.

DAVID E. HERRICK has been appointed instructor in forestry at the Iowa State College. He holds the B. S. degree in forestry from Iowa State. After graduation Herrick, in partnership with another forestry graduate, operated a small sawmill in southern Iowa.

LEONARD F. KELLOGG has been appointed to the staff position of professor of forestry at the Iowa State College, effective January 1, 1949. He succeeds Professor A. W. Goodspeed who left the teaching staff at Ames on February 1 to assume duties as professor of forest management at the University of West Virginia. Kellogg, a native Iowan, holds degrees in forestry from the University of California and Yale University. Since 1926, he has been on the staff of the Central States Forest Experiment Station, Columbus, Ohio.

Ozark Stands Understocked

The Southern Forest Survey, in its first cruise of the 24 counties in the Arkansas Ozarks, found that forests cover 6 million acres—60 percent of the land. Two-thirds of the timber stands are understocked, and the saw timber is mostly in small trees and often too scattered for logging. The upland hardwood and upland hardwood-pine types make up 79 percent of the forest. The shortleaf pine type includes 12 percent, bottomland hardwood 5 percent, and eastern redcedar 4 percent. More than half of the forest acreage is in cordwood stands, 31 percent more is below cordwood size, and only 17 percent is in sawtimber stands.

Consultants Choose Officers

Announcement of officers appointed to direct the activities of the national association of forestry consultants has been made by Alexander L. Setzer, East Tennessee Timber Service, Inc., Norris, Tenn., secretary-treasurer. Consulting foresters attending the international meeting of the Society of American Foresters at Boston formed the consultants' organization on December 16, 1948.

Serving as chairman of the group during 1949 is Edward Stuart, Jr., Simmons and Stuart, Burgess Store, Va. J. Atwood Whitman, Glendon, N. C., heads the membership committee. Robert Moore, Danville, Penna., was appointed chairman of a committee on objectives and organization. Serving with him are John Tillinghast, Mount Hope, W. Va., and Don Canterbury, Houston, Texas.

Northwest Angle Timber Sold

A 25-year cutting contract in the historic "Northwest Angle" has been awarded the Minnesota and Ontario Paper Company by the United States Indian Service.

This most northerly portion of the United States belongs to the Red Lake band of the Chippewa Indians. Approximately 70 percent of the 130 square miles is involved in the timber transaction, and contains an estimated 318,000 cords.

Shade Tree Experts Meet

The Midwestern Chapter of the National Shade Tree Conference met in Chicago on February 17 and 18 to consider various technical applications of shade tree growth and care.

Among the talks given were ones concerned with hormones in relation to plant growth, care of evergreens, methods of handling trees in relation to power lines, the role of instruments in tree physiology, and the value of chemicals for eradicating stumps by burning.

Noel B. Wysong is vice president of the Midwestern Chapter.

Otsego Forest Cooperative Reports Profits in Milling

Benefits to small woodland owners from cooperative ownership of processing facilities are strikingly demonstrated by the recent operations of the Otsego Forest Products Cooperative Association at Cooperstown, New York. Net earnings during the year ended June 30 1948, totaled $13,210 after dividends were paid on capital stock. This amounted to $6.55 per thousand on the 2,017,000 board feet of logs that were processed. Net earnings have been set aside for future patronage dividends to the woodland owners who marketed logs through the Association during the year.

In addition to the earnings made by the Association for its members as producers, savings were also made by members as consumers in purchasing back from the Association, at wholesale prices for farm use, 591 thousand board feet of lumber, mostly hemlock and white pine. This was almost one-fourth of the Association's total sales for the year ended June 30, 1948. Others profited by custom sawing of 106 thousand board feet of lumber.

The Association buys logs on a grade and scale basis delivered at its mill, which is equipped for kiln drying and planing.

The Association operates its band headsaw 3 days a week, averaging 16,000 board feet per day. The mill crew alternates in lumber handling, finishing, and shipping during the remainder of the week, and this schedule enables some of those employed to engage in part-time farming. The whole enterprise fits into employment needs of the community and serves to strengthen the local economy.

About 62 percent of the output is hardwod, chiefly hard maple. Lumber not sold back to members is shipped in wholesale quantities. The average sale value of the entire year's output was $71.93 per thousand board feet. Total income from lumber sale amounted to about $180,000.

M. O. STARK, above, has been appointed conservation forester in Mississippi for the International Paper Company. Formerly he was Forest Management Director of the Mississippi Forestry Commission. He succeeds Robert N. Nonnemacher who has been assigned other responsibilities with the International Paper Company.

Georgia Has Burning Question

Presented by the Georgia Forestry Association and based on facts compiled by the Georgia Department of Forestry and the U. S. Forest Service, a 16-page, 3-color booklet titled "A Burning Question" shows graphically why Georgia's tree crop and forest industries should be protected.

Two-thirds of Georgia is forested, and 70 percent of the timber is in tracts of less than 1,000 acres. Analyzing the situation by districts, the booklet points out the steps necessary to solve the state's fire control problem.

Brenneis, Rickel Promoted

Andrew G. Brenneis has been promoted from supervisor of the Los Padres National Forest to assistant regional forester in charge of personnel management at the San Francisco headquarters of the California Region.

Lloyd A. Rickel, assistant supervisor of the Shasta National Forest, succeeded Mr. Brenneis as supervisor of the Los Padres forest at Santa Barbara.

Wood Molasses Pilot Plant Built in Tennessee Valley

The economic practicality of transforming wood wastes into molasses for livestock feed will be investigated jointly by the U. S. Forest Products Laboratory and the Tennessee Valley Authority.

Announcement of a cooperative agreement to build a pilot plant and produce 20,000 gallons of the wood-sugar molasses a year for livestock feeding tests has been made by George M. Hunt, director of the Laboratory, and Willis M. Baker, director of TVA's Division of Forestry Relations.

The pilot plant will be built at Wilson Dam, Ala., and is expected to be in operation by midyear. It will produce molasses from cull trees that are choking much of the region's forest growth, and from logging residues and the unavoidable wastes of woodworking plants, with emphasis on the use of hardwoods.

The cooperative agreement is planned for 5 years. The Laboratory will furnish a number of tanks and a 1-ton capacity, acid-resistant digester, in which wood is treated to produce the sugars used to make molasses. TVA will furnish the rest of the plant, erect it with the technical help and consultation of the Laboratory, and operate it. Dr. E. E. Harris, chemist specialist of the Laboratory staff, and Mr. L. V. Kline, chief of TVA's Forestry Investigations Branch, will have general direction of the project.

Wood-sugar molasses is produced by converting cellulose and hemicelluloses to sugars by treatment with hot dilute acid in a digester, or hydrolyzer. This produces a weak solution of sugar in water. Evaporation removes most of the water, until the solution contains about half sugar and half water by weight, the normal molasses consistency. For use as feed, the sugar solution usually needs to be neutralized to dispose of the acid. The sugars can also be converted into other products, such as yeast for stock feeding, alcohol, and various other chemicals.

Forest Service Reports Accomplishments, Plans

Noting that it is little more than half a century since Congress passed the law under which the 152 national forests are managed by the Forest Service for the benefit of the people of the United States, Lyle F. Watts, Chief of the Forest Service, told Secretary of Agriculture Brannan in his annual report that these public forests "still represent the largest tangible accomplishment in forest conservation in this country."

Declaring that national security and welfare demand sound management and wise use of all forest land, Mr. Watts said that with our growing population and the steady depletion of many forests in private ownership "our national forests and other public forests undoubtedly will play an increasingly important part in the Nation's economy."

Evidence of the downward trend of the private timber supply is found in the growing demand for timber from the national forests, he said. He pointed out that the 3,800,000,000 board feet of timber cut on the national forests last year was three times the pre-war cut of 1,250,000,000 board feet and that, according to the report, "Many sawmills that formerly had supplies of private timber are now wholly dependent on national forest timber to keep going."

Dealing with the other major resources, the report says that of 21,000,000 recreational visits to national forests last year, 13,000,000 were to established camp, picnic, sports and summer home sites, while 8,000,000 were to less accessible back country such as wilderness or hunting ground. Calling the Nation's water supply "a problem of growing concern," the report tells of a stepped-up program of studies to provide long-term watershed-management plans for more of the 180,000,000 acres of national forest land.

Operation and management of national forests, together with their protection from fire, insects and other menaces, cost less than one-tenth of one percent of the tax dollar, according to the report. Expenditures by the Forest Service for these purposes last year were approximately $32,000,000 while about $13,000,000 additional was spent from funds appropriated by Congress for roads, trails and the purchase of land, part of which can be classed as capital investment. Operating expenses were offset, in large part, by national forest receipts, which last year totalled nearly $25,000,000, a figure that takes no account of the wealth of public services and benefits deriving from the non-revenue producing resources of these publicly owned forests.

Moir Announces Essay Contest

Stuart Moir, forest counsel for the Western Forestry and Conservation Association has announced that the Association will sponsor for the third consecutive year a prize essay contest open to junior and senior students in the six accredited forest schools in California, Idaho, Montana, Oregon, Washington, and British Columbia.

This year's essay topic is "Significant Trends and Developments in Forest Fire Protection." Commenting on the subject, Stuart Moir stated that forest protection is such a vital part of present-day forest management that it is a subject that needs to be impressed on the public mind. Entries must be submitted by October 15, 1949, to respective forestry school deans.

The first prize is $100 in cash with a second prize of $75. In addition, the prize winners have their expenses paid to the annual conference of the Western Forestry and Conservation Association, which will be held in Portland in December.

The 1948 contest was won by H. Benj. Gibson, a forestry student at the University of British Columbia, with James Corlett, a student at the University of Washington, winning second prize.

Wood Trusses Set New Record

Nine huge wood trusses, each 168 feet long and 23 feet high, were lifted bodily 60 feet from the ground and anchored as roof supports on a new building in Tacoma, Wash.

The new structure is the splendid memorial field house at Tacoma's College of Puget Sound, where athletic events can be viewed by 6500 spectators without the obstruction of a single vertical support. The trussed roof section of this reinforced concrete building, which is 168 feet wide and 200 feet long, carries 90,000 board feet of roof decking.

Designated as Monocord truss and prefabricated by the Weyerhaeuser Timber Company at its Longview, Wash. branch operation, each truss contains about 7600 board feet of stress-grade Douglas-fir, harvested on the St. Helens Tree Farm in eastern Cowlitz County and milled at Longview. Lumber was cut to pattern at the Longview plant.

Packaged assemblies, consisting of pre-cut structural wood members, steel plates and hardware, were shipped to Tacoma for assembly on the construction site. Assembly required about one day for each of the trusses, which are the biggest of their kind ever to be raised in one complete unit.

Seedlings Flown to Iceland

Norway plans to ship 100,000 tree seedlings by air this year to Iceland for reforestation of the island. Shipments will continue for five years during which time the Icelandic government hopes to construct sufficient nurseries to supply its needs.

Conifers from northern Norway thrive in Iceland, past experience has proven.

Bird Dogs Described

Twenty breeds of bird dogs are described and hints on training them given in Illinois Natural History Survey Division Circular 42. The use of dogs to lessen crippling losses of game birds is emphasized. The title of the circular is "Bird Dogs in Sport and Conservation."

New McGRAW-HILL Books

FIELDBOOK OF NATURAL HIISTORY

By E. Laurence Palmer, Professor of Nature and Science Education, Cornell University. 662 pages, 6 x 9. Textbook edition $5.00

Here, in one convenient volume, is an extraordinarily comprehensive guide to natural history. This field book embraces birds, fish, plants, rocks and minerals, the stars, mollusks, reptiles, and mammals—more than 2,000 items and hundreds of pictures arranged and tabulated for easy reference. Each item has its descriptive identification, followed by data on range and location, life history, ecology, and economic importance. Common names, illustrations, and technical classifications are given for each item in this book.

FOREST PATHOLOGY—New Second Edition

By John S. Boyce, Department of Forestry, Yale University. *American Forestry Series.* 526 pages, $6.00

This successful book has been thoroughly revised. Much of it has been entirely rewritten to include a wealth of information on such topics as salt spray injury, Phymatotrichum root rot, phloem necrosis of elm, Adelopus needle cast of Douglas fir, septoria canker of poplars, canker stain of planetree, oak wilt, mimosa wilt, parsimmon wilt, and several other rots. New material has been included on the prevention and control of the deterioration of wood in service.

WOOD TECHNOLOGY

Vol. I—Structure, Identification, Defects, and Uses of the Commercial Woods of the United States

By H. P. Brown, The New York State College of Forestry, Syracuse University; A. J. Panshin, Department of Forestry, Michigan State College, and C. C. Forsaith, The New York State College of Forestry, Syracuse University. *American Forestry Series.* 634 pages, $6.00

This book is a complete rewriting and revision of Brown and Panshin's well known *Identification of the Commercial Timbers of the United States.* It will be followed by a second volume dealing with the physical, mechanical, and chemical properties of wood. Together the volumes will constitute a complete treatment of the subject matter of wood technology. Vol. I covers factual information on the structure, identification, general properties, uses, and major defects of commercial wood in the United States. All material has been brought up to date, clarified, and presented in more logical sequence.

WILDLIFE MANAGEMENT

Upland Game and General Principles

By Reuben Edwin Trippensee, Department of Forestry and Wildlife Management, University of Massachusetts. *American Forestry Series.* 479 pages, $5.00

Here is a simple, direct, quantitative approach to the process of making the land produce sustained crops of wild animals. The book gives a summary of the life histories of important game animals of North America, with techniques for their management. It also discusses the farm, the forest, and wilderness conditions as these relate to wild animals, and suggests ways whereby the land manager can make his holdings tenable for occupancy by wild animals.

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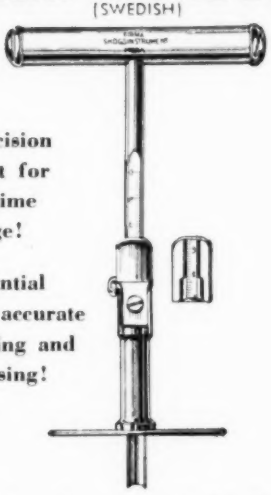

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Purdue graduate. B.S. in Forestry in 1941. Three years with engineering firm as a draftsman. Three years with the U. S. Army in the Intelligence Service working with maps and photos. One year with the U. S. Forest Service in acquisition work. One and one-half years with a veneer company as log yard foreman, buying and marking logs.

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